ANVIK RIVER SONAR
CHUM SALMON ESCAPEMENT STUDY, 2002

By

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ABSTRACT

The Anvik River sonar project has used side-looking sonar, from mid June until the end of July of each year since 1979, to estimate the passage of summer chum salmon *Oncorhynchus keta*. In 2002, an estimated 459,058 summer chum salmon passed the sonar site, exceeding the minimum escapement objective for the Anvik River Biological Escapement Goal of 400,000 to 800,000 chum salmon. Based on 1979-1985 and 1987- 2001 mean quartile passage dates, timing of the 2002 chum salmon run was average. Sixty-three percent of the combined sonar estimates occurred in the nearshore half of the sonar counting ranges in 2002. Visual tower counts verified range distribution and species composition of the sonar tower counts. A consistent diurnal pattern of the chum salmon migration was observed in 2002. Chum salmon passed the sonar site at the highest hourly rates during the darkest hours of the day, and 30.8% of sonar estimates occurred in the 6-hr period between 2200 and 0400 hours. Sex ratio of chum salmon captured in beach seines was 60.9% for 2002. Proportion of females increased through the peak of the run, and then decreased as the run progressed. Combined age-4 and age-5 fish comprised 96.4% of annual chum salmon in 2002. Age-4 fish were the dominant age class with 76.8% of the samples.

KEY WORDS: chum salmon, chinook salmon, Oncorhynchus, Anvik, sonar, oscilloscope

INTRODUCTION

Anvik River sonar project is purposed to monitor escapement of summer chum salmon, *Oncorhynchus keta*, to the Anvik River drainage, believed to be the largest producer of summer chum salmon in the Yukon River drainage (Bergstrom et al. 1999). Additional major spawning populations of summer chum salmon occur in other tributaries of the Yukon River: the Andreafsky located at river kilometer (rkm) 167), Rodo (rkm 719), Nulato (rkm 777), Melozitna (rkm 938), and Tozitna Rivers (rkm 1,096). Spawning tributaries in the Koyukuk River are (rkm 817) the Gisasa (rkm 907) and Hogatza (rkm 1,255) Rivers; and in tributaries to the Tanana River (rkm 1,118): Chena (rkm 1,480), and Salcha (rkm 1,553) Rivers (Figure 1). Chinook *O. tshawytscha* and pink salmon *O. gorbuscha* spawn in the Anvik River concurrently with summer chum salmon. Fall chum, a later run of chum salmon, and coho salmon *O. kisutch* have been reported to spawn in the Anvik River drainage later during fall.

Timely and accurate reporting of information from the Anvik River sonar project allows Yukon River fishery managers to accurately assess strength of the Anvik River summer chum salmon run to meet the established Biological Escapement Goal (400,000 to 800,000). This information is important in assessment of strength of the summer chum salmon run on the Yukon River upstream from the mouth of Anvik River. This assessment is necessary to determine if summer chum salmon abundance will meet upstream harvest and escapement needs. Side-looking sonar, capable of detecting migrating salmon along the banks, has been in place in Anvik River since 1980.

The Electrodynamics Division of the Bendix Corporation developed the side-looking sonar[2] and conducted a pilot study using side-looking sonar to estimate chum salmon escapement to Anvik River in 1979. Results indicated sonar-based estimation of chum salmon escapements to Anvik River was superior to the counting tower method used at that time (Mauney and Buklis 1980).

Project results for escapement studies using sonar technology on the Anvik River from 1979 to 2002 have been reported by Mauney and Buklis (1980), Buklis (1981, 1982, 1983, 1984a, 1984b, 1985, 1986, 1987), Sandone (1989, 1990a, 1990b, 1993, 1994a, 1994b, 1995, 1996), Fair (1997), Chapell (2001), Moore and Lingnau (2001), Lingnau (2002).

Background Information

Commercial and subsistence harvests of Anvik River chum salmon occur throughout mainstem Yukon River from the delta to the mouth of Anvik River, and within the first 19 km of the Anvik River. This section of Yukon River includes Lower Yukon Area Districts 1, 2, and 3, and the lower portion of Subdistrict 4-A in the Upper Yukon Area (Figure 1). Most effort and harvest of this stock occurs in Districts 1 and 2, and in the lower portion of Subdistrict 4-A below the confluence of the Anvik and Yukon Rivers.

[2]Use of a company's name does not constitute endorsement.

In the Lower Yukon Area, run timing of summer chum and chinook salmon overlap, runs begin at river-ice breakup through early July. During this time, commercial fisheries in the Lower Yukon Area have traditionally targeted chinook salmon, but Subdistrict 4-A commercial fisheries have targeted summer chum salmon. In Lower Yukon Area, large-mesh gillnets (stretch mesh greater than 15.2 cm) were employed to harvest chinook salmon. Although these nets were efficient for chinook salmon, the associated harvest of summer chum salmon through 1984 was minor in relation to the size of the chum salmon run. Therefore, before the 1985 season, Alaska Board of Fisheries (BOF), in order to allow directed harvests of summer chum salmon in the Lower Yukon, adopted regulations allowing fishing periods restricted to small-mesh (15.2 cm maximum stretch mesh) gillnets during the chinook salmon season provided (1) the summer chum salmon run was of sufficient size to support additional exploitation, and (2) incidental harvest of chinook salmon during these small-mesh fishing periods did not adversely affect conservation of that species.

Increased market demand prompted allocation disputes between fishers in different districts. In February 1990, BOF established a guideline harvest range of 400,000 to 1,200,000 summer chum salmon for the entire Yukon River, allocated by district and subdistrict based on the average harvests of the previous 15 years (ADF&G 1990). Summer chum salmon escapement to Anvik River exceeded the lower range of the Anvik River Biological Escapement Goal (Clark and Sandone 2001) of 400,000 salmon by an average of 233,000 salmon from 1979 to 1993.

To allow commercial exploitation of surplus chum salmon returning to the Anvik River, in March of 1994 BOF adopted the Anvik River chum salmon fishery management plan to permit a commercial harvest of summer chum salmon in the terminal Anvik River Management Area (ARMA) (ADF&G 1994). In 1996, BOF established a harvest limit of 100,000 pounds of chum salmon roe for the ARMA (JTC 1996). A more complete history and background information can be found in Annual Management Reports for the Yukon Area published each year by the Alaska Department of Fish and Game (ADF&G).

Objectives

The purpose of this project is to monitor the escapement of summer chum salmon to the Anvik River and to assess the age and sex composition of the escapement. Two objectives of this project are to:

1. Estimate the daily summer chum salmon escapement passing the Anvik River sonar site; and

2. Estimate the age and sex composition of the summer chum salmon spawning escapements.

METHODS

Study Area

Anvik River originates at an elevation of 400 m and flows in a southerly direction approximately 200 km to its mouth at rkm 512 of the Yukon River (Figure 1). This narrow runoff stream has a substrate of mainly gravel and cobble. Bedrock is exposed in some of the upper reaches. Yellow River (Figure 2) is a major tributary of the Anvik River drainage and is located approximately 100 km upstream from the mouth of Anvik River. Downstream from the confluence of the Yellow River, Anvik River changes from a moderate gradient system to a low gradient system meandering through a much broader flood plain. Turbid waters from Yellow River greatly reduce water clarity of Anvik River below their confluence. Numerous oxbows, old channel cutoffs, and sloughs are found throughout lower Anvik River.

Anvik River salmon escapements were partially estimated from visual counts made at counting towers from 1972 to 1979 above the confluence of the Anvik and Yellow Rivers (Figure 2). A site 9 km above the Yellow River on the mainstem Anvik River was used from 1972 to 1975 (Lebida 1973; Trasky 1974, 1976; Mauney 1977). From 1976 to 1979, a site on mainstem Anvik River near the confluence of Robinhood Creek and Anvik River was used (Figure 2; Mauney 1979, 1980; Mauney and Geiger 1977). Other than 1974, aerial surveys were conducted in each year since 1961 in fixed-wing aircraft to estimate salmon abundance below the tower site. Since 1979, the Anvik River sonar project has been located approximately 76 km upstream of the confluence of the Anvik and Yukon Rivers, 5 km below Theodore Creek (Figure 2) in Sections 34 and 35, Township 31 North, Range 61 West, Seward Meridian. The land is public, managed by BLM, and leased to ADF&G for public purposes until 2023. Aerial survey data indicate chum salmon spawn primarily upstream of this sonar site.

Sonar Deployment and Operation

Sonar systems operate by transmitting sound waves outward along the riverbed, from transducers located near shore. Echoes from targets passing through the sonar beam are reflected back to the transducer and filtered and processed in the transceiver. Echoes, which satisfy criteria for strength and frequency, are considered valid and are counted as fish. Echo selection criteria are designed to estimate fish passage and minimize debris counts. Echoes are counted and combined to estimate fish abundance. For the Anvik River sonar salmon counting project, all fish targets are considered salmon. Paired visual counts confirm nearly all fish observed are salmon.

During the 2002 season, 1981-model sonar "counters" (transceivers) were deployed and operated according to guidelines described by Bendix Corporation (1981) on each bank to estimate chum salmon passage (Figure 2). Transducers were deployed and operated without the prescribed artificial aluminum substrate throughout the season. This practice of operating without an artificial substrate was first employed on the Anvik River in 1986 (Buklis 1986). Right (west)

and left (east) bank sites used in previous years were probed to locate uniform river bottom gradients that would provide optimum linear surfaces for ensonification. Each sonar transducer was mounted to a pipe configuration, to allow transducer movement during aiming without affecting stability. Sandbags were placed on top of the pipe base to ensure stability. Transducers were aimed perpendicular to the current and were offset to prevent interference (cross-talk) between opposing banks (Figure 3). To prevent fish passage inshore of the transducer, portable fish leads constructed of aluminum pipe spaced 1.5 inches apart were installed downstream of the transducer. Extending from shore to approximately 1 m beyond the transducer, fish leads were at an oblique angle from shore leading upstream. On the right bank, a counting tower of aluminum scaffolding material approximately 3 m in height was placed between the bank and transducer in the river upstream of the fish lead for visual observation of salmon when water conditions permitted. No tower was necessary on the left bank, as visibility from the high bank was sufficient to see fish. Transducers, leads, and counting tower were moved inshore or offshore as required by fluctuating water levels.

Transducers were aimed, and ranges adjusted, to prevent echoes resulting from the stream bottom or surface interface to register as 'counts' by the sonar electronics. Sensitivity, as measured in voltage from peak to peak, was adjusted to the highest level without registering false 'counts'. This level was usually the maximum possible for this equipment. Sonar ensonification ranges were adjusted in response to changing river conditions. The 1981-model counter has a maximum range of 30 m. Because of the conical shape of the sonar beam, its width and height increase with distance from the transducer. The ensonified zone of the river encompassed approximately the bottom one-half of the vertical water column within counting range throughout operations.

Counters used on this sonar project divided each of the ensonified ranges into 16 sectors of equal length. Sector length was dependent on each transducer's total range of ensonification and was therefore 1/16 of the total range. In subsequent analyses of data, range is divided into 16 sectors, numbers originated at the transducer face and continued offshore toward the thalweg.

Sonar equipment was installed approximately 150 m upstream from the field campsite. Right bank transducer was situated on a gradually sloping gravel bar inside of a slight bend in the river. Left bank transducer was located on the outside of the bend where water level increased more rapidly and the current was faster than at the site inside the bend.

Historical run timing was used to plan Anvik River sonar project start dates. In most years, some salmon pass the sonar site before and after cessation of sonar operations. However, these numbers likely comprise only a small fraction of the total run. Criteria for terminating sonar sampling were daily chum salmon passage estimates of one percent or less of the season's total passage estimate for three out of four days.

Sonar Calibration and Sampling

Each sonar transceiver was calibrated at least four times daily by observing passing fish targets using an oscilloscope. In this and past studies using the Bendix system, the term calibrate refers to adjusting the transducer pulse rate (also known as ping rate) to account for variable fish swimming speeds. Fish passing through the sonar beam produce a distinctive oscilloscope trace that resembles a tall, momentarily suspended spike. During each calibration period, the number of fish detected by an operator using an oscilloscope was compared to estimates automatically recorded by the sonar electronics.

Fish velocity control setting, which controls the sonar counter's ping rate, was adjusted immediately after a calibration if the sonar to oscilloscope estimate ratio varied from 1.0 by 15% or more. If the ratio was greater than 1.15 or less than 0.85 the existing fish velocity setting was multiplied by the calculated ratio to obtain a new fish velocity control setting. If adjustments were made to the sonar unit, the change was documented in the calibration log, and an additional calibration was made to ensure the new sonar:oscilloscope estimate ratio was within accepted limits and to initialize the counting period. Each initial calibration lasted for at least 15 minutes, until the observer estimated 100 fish had passed, or if the observer noticed immediately fish velocity settings were erroneous, whichever came first.

During setup and at least twice a day when conditions allowed, operators attempted to visually count passing fish from counting towers. This counting helped train personnel in oscilloscope monitoring and gave an estimate of the daily proportion of pink salmon, since sonar counters do not distinguish between species of fish. This daily proportion of pink salmon was applied to the adjusted daily fish passage estimate to yield a daily estimate of pink salmon passage. Observers wore polarized sunglasses to reduce water surface glare. Glare, low light, wind ripples, rain, and turbid water conditions at times hampered tower observations. Aerial and carcass surveys were used to obtain a separate estimate for chinook salmon abundance. These estimates were not subtracted from the sonar fish estimate because chinook salmon abundance is low relative to other salmon runs in Anvik River.

Four daily calibration times were deemed adequate to monitor the diurnal-timing pattern of the salmon migration (Sandone 1996). Calibrations were normally conducted during 0600, 1200, 1800, and 2400 hours. Occasionally, calibration times deviated from prescribed times. Counting periods were defined by each calibration event. An adjustment factor, specific to each counting period and to each bank was calculated using the following formula:

$$A_{b,n} = \frac{OC_{b,n}}{SC_{b,n}}$$

Where A = periodic adjustment factor,
b = right or left bank,
n = counting period (0000-0600, 0600-1200, 1200-1800, or 1800-2400),
OC = oscilloscope counts, and

SC = sonar counts.

For each bank, adjusted passage estimates were calculated by multiplying each calibration period's adjustment factor by unadjusted sonar estimates for each hour within the calibration period. Adjusted estimates were further corrected for missing data and corrected hourly estimates were entered into a spreadsheet program on a desktop computer. Resulting corrected sonar estimates for each hour within a day were summed, yielding the estimated fish passage for that day for that bank. Daily passage of fish for the whole river was determined by summing the daily bank-specific estimates. Daily adjustment or correction factors for each bank and for both banks combined were calculated by dividing the daily-corrected estimates by raw sonar estimates. Raw sector estimates for each day were corrected using the overall daily correction factor. Corrected hourly and sector estimates were used to describe temporal and spatial distribution of the run.

If hourly sector estimates were lacking because of debris, printer malfunction, or weather-related disruptions of sonar operations, passage estimates were calculated by averaging sector estimates for the hour before and after the missing data. When hourly data were not recorded for three to 12 hours within one day, daily estimate was calculated by dividing corrected partial daily value by mean proportion of corrected estimates of the corresponding hours for the first day before and after the day in question with complete data collection. When conditions forced a suspension of sonar sampling on only one bank for 12 hours or more, that bank's daily estimates were calculated from fish passage on the opposite bank in conjunction with a bank-specific passage proportion based on all days during the season with full counts from both banks. Whenever sampling was suspended on both banks for an entire day, the daily total fish passage estimate was made using straight-line interpolation between the previous day's, and the following day's whole river corrected estimates. To recreate spatial and temporal distribution of estimates made for time periods with no recorded data for more than two hours, the seasonal total fish estimate for each hour and sector of each bank was divided by the adjusted season total for that bank. Resulting proportions (one for every hour and sector) were multiplied by the interpolated daily estimate, resulting in an interpolated estimate of the spatial and temporal fish passage.

Age-Sex-Length Sampling

Temporal strata, used to characterize age and sex composition of the chum salmon escapement, were defined as quartiles using dates on which 25%, 50%, 75%, and 100% of the total run had passed the sonar site. These quartile-sampling strata were determined postseason based on 2002 run timing data. They represent an attempt to sample the escapement for age-sex-length (ASL) information in relative proportion to the total run. In 2002, these strata were: Pre-3 July, 3-6 July, 7-11 July, and 12 July until end of the season.

To meet regionwide standards for sample size needed to describe a salmon population, the initial seasonal ASL sample goal was 608 chum salmon, with a minimum of 162 chum salmon samples collected during each temporal stratum (Bromaghin 1993). Sample size goals are based on accuracy (d) and precision (α) objectives of $d = 0.10$ and $\alpha = 0.05$, assuming two major age classes,

and two minor age classes with a scale rejection rate of 15%. Beach seining goal for chinook salmon was to sample all fish captured while pursuing the chum salmon sampling goal.

A beach seine (31 m long, 66 meshes deep, 6.35-cm mesh) was drifted, beginning approximately 10 m downstream of the sonar site to capture chum and chinook salmon to collect ASL data (Figure 3). All resident fresh-water fish captured were tallied by species and released. Pink salmon were counted by sex, based on external characteristics, and released. Chum salmon were placed in a holding pen and each was noted for sex, measured to the nearest 5 mm from mid-eye to fork-of-tail, and one scale was taken for age determination. Where possible, scales were removed from an area posterior to the base of the dorsal fin and above the lateral line on the left side of the fish (Clutter and Whitesel 1956). The adipose fin was clipped on each sampled chum salmon to prevent re-sampling. If any chinook salmon were caught, they were sampled using the same methods, except three scale samples were taken from each fish. A separate project to characterize age and sex composition of Anvik River chinook salmon involved collecting ASL samples from chinook salmon carcasses immediately after the sonar program terminated.

Climatological and Hydrologic Sampling

Climatological and hydrologic data were collected at approximately 1800 hours each day at the campsite. Relative river depth was monitored using a staff gauge marked in 1 cm increments. Change in water depth was presented as negative or positive increments from the initial reading of 0.0 cm. Water temperature was measured in degrees Celsius (C) near shore at a depth of approximately 50 cm. Daily maximum and minimum air temperatures were recorded in degrees C. Subjective notes on wind speed and direction, cloud cover, and precipitation were recorded.

RESULTS

Sonar Assessment

Two sonar systems, one on each riverbank, were operated in 2002. These sites were the same sonar sites used in 2001 located farther up river to avoid an island, which had formed mid river. The right bank transducer was deployed on a slight inside bend, where a gravel bar slopes gently toward the thalweg. The left bank transducer was deployed from a more steeply sloping cut-bank on the outside of the same bend.

In 2002, right bank sonar operations began on 22 June. The left bank sonar system became operational on 25 June. Water clarity varied through the season, which sometimes allowed excellent visual confirmation of sonar passage estimates and species apportionment and other times did not. The sonar systems on both banks operated through 24 July.

Escapement Estimates and Run Timing

The 2002 summer chum salmon passage estimate for the 33-day period from 22 June through 24 July was 459,058 (Table 1). This period includes estimates for missing sector/hourly counts and expansions for left bank passage on 22 to 24 June and 1 to 2 July and right bank passage on 9, 17, 23, 24 July.

Summer chum salmon passage dates were similar to historic run timing data, based on 1979-1985 and 1987-2001 runs (Table 2). First, third and fourth quartile days were the same as historic means and the median day was one day earlier (Table 2). The central half of the run passed between 3 July and 12 July (Table 2) and its duration, 9 days, was near the historic mean of 10.0 days. Daily passage estimates between first and third quartile days ranged from 11,032 to 35,944 fish (Table 1). In nine days of the central half of the chum salmon run an estimated 242,368 fish passed the sonar sites. The median day of summer chum salmon passage, 7 July, was also the peak passage day when 35,944 summer chum salmon, 0.078 proportion of the estimated total escapement (Table 3), were estimated to have passed (Figure 4).

From 22 June through 24 July 2002 a total of 27:12 h of sonar calibrations were conducted at the right bank site (Table 4). Right bank sonar:oscilloscope proportions averaged 1.23. A total of 3,691 chum, 72 chinook, and 1,148 pink salmon were visually counted from a tower in 15:25 h of visual monitoring on the right bank. On the left bank, a total of 28:16 h of sonar calibrations were conducted. Left bank sonar:oscilloscope proportions averaged 0.97. A total of 1,089 chum and 8 chinook, and 529 pink salmon were visually counted from the left bank tower in 7:58 h of visual monitoring (Table 4).

The first pink salmon in 2002 were observed from the right bank tower on 3 July (Table 4 and Table 5). Right bank salmon proportionment was initially calculated from adjusted sonar estimates at 0.4% on 30 June, and peaked at 55% on 15 July (Figure 5). Daily estimates of the pink salmon proportion of the left bank salmon passage started at 25% of the adjusted sonar estimates on 6 July, and peaked at 72% on 18 July. After 5 July, the daily pink salmon proportion of all passing salmon was usually higher on the left bank than on the right bank, except for 9 July, 14-17 July and 24 July (Figure 5). Daily number of pink salmon passing was higher on the right bank on all but four days from 3 July through 24 July (Figure 5). Daily pink salmon passage for the both banks combined peaked on 14 July with a passage of 17,900 fish. Although the percentage of pink salmon remained high, actual abundance appeared to be declining with chum salmon abundance when sonar sampling was terminated on 24 July (Figure 6).

The 2002 chum salmon escapement estimate of 459,058 was 33.2% below the mean Anvik River escapement estimate of 687,685 fish, based on 1979-2001 data (Table 2, Appendix Table A). The 2002 escapement estimate exceeded the lower range of the recently adopted Biological Escapement Goal (BEG) of 400,000 to 800,000 summer chum salmon. Detailed passage estimate and proportions for each hour and each sector for the season can be found in Appendix Table B.

Spatial and Temporal Distribution

Buklis (1982) first reported a distinct diurnal salmon migration pattern during the 1981 season with a higher proportion of the migration passing the sonar site during darker hours of the day (Table 6, Figure 7). Similar diurnal patterns were reported from 1985 through 2001. Temporal distribution of sonar estimates indicates a distinct diurnal pattern. Between the six hours of 2200 and 0400, 30.8% of estimates were recorded.

Before 2002, in all but three years sonar was used to estimate Anvik River chum salmon escapement, most of the escapement passage had been associated with the right bank. In the three exceptional years only 43%, 45%, and 39% (1992, 1996, and 1997), of the total adjusted estimates were observed on the right bank (Sandone 1994a; Fair 1997; Chapell 2001). The shift to left bank was attributed to low water conditions that affected chum salmon migration patterns at the sonar site. The 2002 chum salmon migrations followed the dominant right bank orientation trend with 75.4% of estimated chum salmon passing on the right bank (Table 5, Figure 8).

A fundamental assumption of the Anvik River Sonar project is, because of the bank-oriented migration behavior of chum salmon, the two sonar systems based on opposite shores detect essentially all chum salmon passing the sonar site. In 2002, this assumption was supported by lower relative passage estimates in the offshore sonar sectors (Table 7, Figure 8). During the 2002 season, sonar sectors in the nearshore half of the right bank counting range accumulated 75% of the annual right bank sonar estimates. On the left bank, the nearshore half of the sonar counting range accumulated 36% of the annual left bank sonar estimates (Table 7, Figure 8). Likely, the extremely low water allowed or forced fish away from the bank and into deeper water explains the low (36%) nearshore passage on the left bank in 2002.

During the 2002 season, minor day-to-day changes of fish passage proportions between sector estimates were probably caused by changes in placement and aiming of the transducer in response to fluctuating water levels, rather than by changes caused by fish migratory patterns.

Age and Sex Composition

In 2002, beach seine sets were made on 10 days from 25 June to 22 July (Table 8). Of 536 chum salmon sampled, 470 (87.7%) could be aged, slightly higher than the 85% expected rate (Table 8). The number of fish sampled for the first through fourth passage strata was 169, 113, 106, and 193 chum salmon. Of those fish sampled for ASL data in each stratum, 137, 90, 93, and 150 had scales, which could be aged.

Four strata sampled during the 2002 season dominated by age-4 chum salmon, accounted for 64.2%, 82.2%, 79.6%, and 81.2% of the passage in their respective passage strata (Appendix Table C, Figure 9). The overall age composition of escapement, using temporal strata determined by the closest sample dates and weighted by escapement estimates, was 1.9% age-3, 76.8% age-4, 19.6%

age-5, and 1.7% age-6 (Appendix Table C). Predominant age classes of age-4 and age-5 salmon accounted for 96.4% of the four age classes observed in 2002. In comparison to historical mean values from 1972-2001, the age-4 proportion of the 2002 run was 19.6% higher and the age-5 proportion was 19.5% lower. These results indicate an average survival rate for age-4 and age-5 fish during their life history.

Age and sex composition of the Anvik River chum salmon escapement passing the sonar site usually changes through the duration of the run. Usually, the trend is an increasing proportion of younger salmon and a higher proportion of female salmon as the run progresses (Fair 1997). This trend was also observed in the 2002 run (Appendix Table C, Figure 9). Using temporal strata determined by the closest beach seine sample dates and weighted by escapement estimates, females comprised 54.0% of the first stratum, followed by an increase to 65.6% in the second stratum, then a similar proportion of 64.5% in the third stratum. The fourth stratum of chum salmon collected showed a decrease in the percentage females to 59.1%. Of the entire chum salmon run estimate for 2002, 60.9% were females. Since 1979, females have dominated the escapement in 22 of the 24 years; the exceptions were 1995 and 1996 (Figure 10). Chum salmon were also sampled for length. Table 9 compares mean length by age and sex.

Hydrologic and Climatological Conditions

Anvik River water level in 2002 was extremely low and dropped steadily until 12 July when it reached 43.2 cm below the initial level recorded on 20 June. Water level then rose 6.6 cm to 35.6 cm below the initial setting on 14 July (Table 10, Figure 11). Water level continued to drop after 15 July to 41.9 cm below the initial setting by season end on 23 July. Maximum daily water temperature was 17°C and minimum daily water temperature 9°C. The maximum daily air temperature was 27°C and minimum daily air temperature was -1°C (Table 10, Figure 11). Both maximum and minimum air temperatures generally bound water temperatures throughout the season.

DISCUSSION

The 2002 Anvik River summer chum salmon escapement estimate was 33% below the 1979-2001 average escapements of 687,685, but increased 105% over 2001. Summer chum salmon abundance has been below average to poor since 1997, although parent-year escapements were very good from 1995 through 1997. Since 76.8% of these fish were 4-year-olds, the indication is the survival of 1998 offspring was significantly better than the survival rate of the 1997 brood year even though 1997 had a larger estimated escapement. Although the exact reasons for the low salmon runs are unknown, scientists speculate poor marine survival results from, or is accentuated, by localized weather conditions in the Bering Sea (Kruse 1998).

In 2002, Yukon River run assessment projects, and the Anvik River sonar project provided early indications the Yukon River summer chum salmon run was weak. The 2002 Yukon River and Anvik River sonar projects' assessments of summer chum salmon runs agreed with the below average escapement estimates in the Andreafsky, Nulato, Gisasa, and Chena Rivers, and Clear, Caribou, Henshaw, and Kaltag Creeks (JTC 2002). The Yukon River summer chum commercial fishery was managed conservatively by reducing fishing periods. Commercial harvest was taken incidental to fishing a directed chinook fishery except for two directed chum salmon commercial fishing periods in District 6. Total estimated Alaska portion of the commercial harvest was 13,568 summer chum salmon (JTC 2002). The summer chum salmon commercial harvest was third lowest since 1968. The preliminary summer chum salmon subsistence and personal use harvest for 2002 is 41,776 and test fish harvests of 2,092 for a total estimated harvest of 43,868 summer chum salmon (Brase 2003). This estimate is 60% below the recent 10-year (1992-2001) average of 108,774.

Bendix Replacement

ADF&G estimates salmon escapement on many Alaskan rivers with Bendix sonar equipment. Bendix sonar on the Anvik River produced dependable data for fisheries managers since 1980. This sonar system has not been upgraded in many years and is no longer in production or serviced by Bendix.

New equipment purchased by the Department and produced by Hydroacoustic Technology, Inc. (HTI) will eventually replace old sonar systems. The HTI sonar system has a farther range, is capable of saving collected data, and can determine direction of travel. In 2000 and 2002, the HTI sonar was tested concurrently with existing sonar in preparation for a change to this sonar in the future. Testing will continue in the upcoming 2003 field season.

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Table 1. Anvik River summer chum salmon daily and cumulative counts by bank and total, 2002.

	Daily			Cumulative		
Date	Right Bank	Left Bank	Total	Right Bank	Left Bank	Total
22-Jun	67 [a]	11 [b]	78	67	11	78
23-Jun	1,849	301 [b]	2,150	1,916	312	2,228
24-Jun	1,872	305 [b]	2,177	3,788	617	4,405
25-Jun	4,936	876 [c]	5,812	8,724	1,493	10,217
26-Jun	4,451	2,095	6,546	13,175	3,588	16,763
27-Jun	5,036	1,305	6,341	18,211	4,893	23,104
28-Jun	13,869	2,094	15,963	32,080	6,987	39,067
29-Jun	14,552	1,863	16,415	46,632	8,850	55,482
30-Jun	10,022	1,115	11,137	56,654	9,965	66,619
1-Jul	17,794	2,426 [d]	20,220	74,448	12,391	86,839
2-Jul	19,485	2,657 [d]	22,142	93,933	15,048	108,981
3-Jul	17,833	3,046	20,879	111,766	18,094	129,860
4-Jul	9,230	1,802	11,032	120,996	19,896	140,892
5-Jul	24,042	2,827	26,869	145,038	22,723	167,761
6-Jul	21,642	4,955	26,597	166,680	27,678	194,358
7-Jul	29,462	6,482	35,944	196,142	34,160	230,302
8-Jul	17,320	9,034	26,354	213,462	43,194	256,656
9-Jul	16,684 [d]	8,345	25,029	230,146	51,539	281,685
10-Jul	17,122	8,519	25,641	247,268	60,058	307,326
11-Jul	14,007	7,192	21,199	261,275	67,250	328,525
12-Jul	14,234	8,590	22,824	275,509	75,840	351,349
13-Jul	14,178	7,525	21,703	289,687	83,365	373,052
14-Jul	10,001	6,398	16,399	299,688	89,763	389,451
15-Jul	8,059	4,968	13,027	307,747	94,731	402,478
16-Jul	7,960	6,154	14,114	315,707	100,885	416,592
17-Jul	6,271 [d]	3,936	10,207	321,978	104,821	426,799
18-Jul	5,183	1,230	6,413	327,161	106,051	433,212
19-Jul	2,720	2,112	4,832	329,881	108,163	438,044
20-Jul	3,289	1,372	4,661	333,170	109,535	442,705
21-Jul	3,474	815	4,289	336,644	110,350	446,994
22-Jul	5,106	1,218	6,324	341,750	111,568	453,318
23-Jul	2,557 [e]	379	2,936	344,307	111,947	456,254
24-Jul	2,046 [e,f]	758	2,804	346,353	112,705	459,058
Total	346,353	112,705	459,058			

a Right bank sonar counting began at 17:00.

b Calculated using relationship of right:left bank fish passage estimates from days immediately following.

c Left bank sonar counting began at 00:00.

d Calculated using relationship of right:left bank fish passage from days immediately before and after.

e Calculated using relationship of right:left bank fish passage estimates from days immediately preceding, due to spawners in the sonar beam.

f Right and left bank sonar counts terminated at 24:00.

Table 2. Annual Anvik River sonar passage estimates and associated passage timing statistics for the summer chum salmon runs, 1979-2002. [a]

Year	Sonar Passage Estimate [b]	Day of First Salmon Counts	First Quartile Day	Median Day	Third Quartile Day	First Count & First Quartile	Days Between Quartiles: First & Median	Median & Third	First & Third
1979	277,712	23-Jun	2-Jul	8-Jul	12-Jul	9	6	4	10
1980	482,181	28-Jun	6-Jul	11-Jul	16-Jul	8	5	5	10
1981	1,479,582	20-Jun	27-Jun	2-Jul	7-Jul	7	5	5	10
1982	444,581	25-Jun	7-Jul	11-Jul	14-Jul	12	4	3	7
1983	362,912	21-Jun	30-Jun	7-Jul	12-Jul	9	7	5	12
1984	891,028	22-Jun	5-Jul	9-Jul	13-Jul	13	4	4	8
1985	1,080,243	5-Jul	10-Jul	13-Jul	16-Jul	5	3	3	6
1986	1,085,750	21-Jun	29-Jun	2-Jul	6-Jul	8	3	4	7
1987	455,876	21-Jun	5-Jul	12-Jul	16-Jul	14	7	4	11
1988	1,125,449	21-Jun	30-Jun	3-Jul	9-Jul	9	3	6	9
1989	636,906	20-Jun	1-Jul	7-Jul	13-Jul	11	6	6	12
1990	403,627	22-Jun	2-Jul	7-Jul	15-Jul	10	5	8	13
1991	847,772	21-Jun	1-Jul	10-Jul	16-Jul	10	9	6	15
1992	775,626	29-Jun	5-Jul	8-Jul	12-Jul	6	3	4	7
1993	517,409	19-Jun	5-Jul	12-Jul	18-Jul	16	7	6	13
1994	1,124,689	19-Jun	1-Jul	7-Jul	11-Jul	12	6	4	10
1995	1,339,418	19-Jun	1-Jul	6-Jul	11-Jul	12	5	5	10
1996	933,240	18-Jun	25-Jun	1-Jul	6-Jul	7	6	5	11
1997	605,752	19-Jun	28-Jun	3-Jul	10-Jul	9	5	7	12
1998	487,301	22-Jun	5-Jul	10-Jul	14-Jul	13	5	4	9
1999	437,356	27-Jun	6-Jul	10-Jul	16-Jul	9	4	6	10
2000	196,349	21-Jun	8-Jul	11-Jul	13-Jul	17	3	2	5
2001	224,058	26-Jun	6-Jul	10-Jul	15-Jul	10	4	5	9
2002	459,058	22-Jun	3-Jul	7-Jul	12-Jul	11	4	5	9
Mean [c]	687,685	22-Jun	3-Jul	8-Jul	12-Jul	10.4	5.1	4.9	10.0
Median [c]	561,581	21-Jun	3-Jul	8-Jul	13-Jul	10.0	5.0	5.0	10.0
SE	367,122		3.8	3.4	3.1	3.1	1.6	1.4	2.4

[a] The mean and standard error of the timing statistics includes estimates from years 1979-1985 and 1987-2002. In 1986, sonar counting operations were terminated early, probably resulting in the incorrect calculation of the quartile statistics. Therefore, the 1986 run timing statistics were excluded from the calculation of the overall mean and timing statistic and associated SE.

[b] Includes 1986 passage data.

[c] Does not include data from 2002 so that the current year can be compared to the historical averages.

Table 3. Anvik River summer chum salmon daily and cumulative proportions by bank and total, 2002. [a]

	Daily			Cumulative		
Date	Right Bank	Left Bank	Total	Right Bank	Left Bank	Total
22-Jun	0.000	0.000	0.000	0.000	0.000	0.000
23-Jun	0.004	0.001	0.005	0.004	0.001	0.005
24-Jun	0.004	0.001	0.005	0.008	0.001	0.010
25-Jun	0.011	0.002	0.013	0.019	0.003	0.022
26-Jun	0.010	0.005	0.014	0.029	0.008	0.037
27-Jun	0.011	0.003	0.014	0.040	0.011	0.050
28-Jun	0.030	0.005	0.035	0.070	0.015	0.085
29-Jun	0.032	0.004	0.036	0.102	0.019	0.121
30-Jun	0.022	0.002	0.024	0.123	0.022	0.145
1-Jul	0.039	0.005	0.044	0.162	0.027	0.189
2-Jul	0.042	0.006	0.048	0.205	0.033	0.237
3-Jul	0.039	0.007	0.045	0.243	0.039	0.283
4-Jul	0.020	0.004	0.024	0.264	0.043	0.307
5-Jul	0.052	0.006	0.059	0.316	0.049	0.365
6-Jul	0.047	0.011	0.058	0.363	0.060	0.423
7-Jul	0.064	0.014	0.078	0.427	0.074	0.502
8-Jul	0.038	0.020	0.057	0.465	0.094	0.559
9-Jul	0.036	0.018	0.055	0.501	0.112	0.614
10-Jul	0.037	0.019	0.056	0.539	0.131	0.669
11-Jul	0.031	0.016	0.046	0.569	0.146	0.716
12-Jul	0.031	0.019	0.050	0.600	0.165	0.765
13-Jul	0.031	0.016	0.047	0.631	0.182	0.813
14-Jul	0.022	0.014	0.036	0.653	0.196	0.848
15-Jul	0.018	0.011	0.028	0.670	0.206	0.877
16-Jul	0.017	0.013	0.031	0.688	0.220	0.907
17-Jul	0.014	0.009	0.022	0.701	0.228	0.930
18-Jul	0.011	0.003	0.014	0.713	0.231	0.944
19-Jul	0.006	0.005	0.011	0.719	0.236	0.954
20-Jul	0.007	0.003	0.010	0.726	0.239	0.964
21-Jul	0.008	0.002	0.009	0.733	0.240	0.974
22-Jul	0.011	0.003	0.014	0.744	0.243	0.987
23-Jul	0.006	0.001	0.006	0.750	0.244	0.994
24-Jul	0.004	0.002	0.006	0.754	0.246	1.000
Total	0.754	0.246	1.000			

[a] Second and third quartiles in box. Mean quartile in bold outlined box.

Table 4. Daily summary of sonar calibrations and visual salmon counts from towers, Anvik River, 2002.

	Right Bank								Left Bank							
	Sonar Calibrations				Visual Counts				Sonar Calibrations				Visual Counts			
	Elapsed				Elapsed	Net Upstream			Elapsed				Elapsed	Net Upstream		
	Time	Sonar	Scope	Sonar/	Time	Salmon Passage			Time	Sonar	Scope	Sonar/	Time	Salmon Passage		
Date	(hrs:min)	Count	Count	Scope	(hrs:min)	Chum	Chinook	Pink	(hrs:min)	Count	Count	Scope	(hrs:min)	Chum	Chinook	Pink
22-Jun	0:30	18	8	2.25	0:00				0:00				0:00			
23-Jun	1:05	59	65	0.91	0:15	1	0	0	0:00				0:00			
24-Jun	0:58	35	74	0.47	0:00				0:00				0:00			
25-Jun	1:03	157	149	1.05	0:15	7	0	0	1:10	16	27	0.59	0:15	1	0	0
26-Jun	0:55	135	152	0.89	0:15	4	1	0	1:00	17	20	0.85	0:15	3	0	0
27-Jun	0:45	148	149	0.99	0:23	50	0	0	0:45	6	17	0.35	0:00			
28-Jun	1:10	674	617	1.09	0:23	52	0	0	0:56	56	52	1.08	0:00			
29-Jun	0:48	856	500	1.71	1:16	156	0	0	1:00	55	68	0.81	0:05	0	0	0
30-Jun	1:06	283	289	0.98	0:55	281	11	0	1:25	35	34	1.03	0:10	3	0	0
1-Jul	1:24	1402	697	2.01	0:22	139	0	0	0:15	26	28	0.93	0:15	27	0	0
2-Jul	1:11	802	624	1.29	0:12	102	0	0	0:19	31	34	0.91	0:05	11	0	0
3-Jul	0:32	388	400	0.97	0:19	83	0	3	1:03	79	94	0.84	0:15	33	0	0
4-Jul	0:50	305	325	0.94	0:30	206	2	24	1:13	93	101	0.92	0:15	21	0	0
5-Jul	0:43	513	508	1.01	0:24	140	4	5	1:14	95	122	0.78	0:15	24	0	0
6-Jul	0:49	621	570	1.09	0:35	386	3	45	1:10	189	215	0.88	0:25	98	2	32
7-Jul	0:21	403	400	1.01	0:30	134	1		0:58	321	338	0.95	0:13	74	0	26
8-Jul	0:27	408	400	1.02	0:30	147	3	39	0:27	408	400	1.02	0:30	111	0	41
9-Jul	0:49	353	366	0.96	0:25	163	11	42	0:31	279	244	1.14	0:15	54	0	7
10-Jul	0:36	446	458	0.97	0:30	224	1	52	0:44	342	344	0.99	0:30	141	1	80
11-Jul	0:36	448	450	1.00	0:25	150	3	49	0:48	400	395	1.01	0:15	23	1	18
12-Jul	0:52	641	538	1.19	0:30	175	4	72	0:50	486	465	1.05	0:30	235	3	136
13-Jul	0:46	564	508	1.11	0:20	48	3	26	0:54	529	425	1.24	0:15	11	0	7
14-Jul	0:34	472	425	1.11	0:30	100	2	119	1:08	548	487	1.13	0:15	16	0	15
15-Jul	0:30	428	400	1.07	0:58	301	6	362	0:57	310	303	1.02	0:30	79	1	62
16-Jul	0:28	384	350	1.10	0:51	173	6	154	0:59	636	461	1.38	0:30	68	0	44
17-Jul	0:34	320	299	1.07	0:30	121	5	56	0:53	248	234	1.06	0:15	14	0	6
18-Jul	0:36	1181	432	2.73	0:47	128	1	31	1:06	271	251	1.08	0:30	10	0	26
19-Jul	0:57	116	127	0.91	0:30	65	0	33	1:15	206	203	1.01	0:10	11	0	8
20-Jul	0:59	169	165	1.02	0:30	45	1	14	1:00	83	81	1.02	0:15	8	0	3
21-Jul	1:07	235	217	1.08	0:30	51	0	10	0:49	79	84	0.94	0:15	2	0	3
22-Jul	1:15	180	161	1.12	0:20	22	0	1	1:10	94	84	1.12	0:10	4	0	1
23-Jul	0:56	253	149	1.70	0:30	32	2	6	1:02	37	37	1.00	0:10	6	0	10
24-Jul	1:00	479	172	2.78	0:15	5	2	5	1:15	48	48	1.00	0:15	5	0	4
Total	27:12	13,876	11,144		15:25	3,691	72	1,148	28:16	6,023	5,696		7:58	1,089	8	529
Mean	0:48			1.23	0:30				0:55			0.97	0:17			

Table 5 Anvik River raw sonar estimates, calibration adjustment factors, chum and pink salmon passage estimates by bank and day, 2002.

	Right Bank					Left Bank					Combined Banks					
	Raw		Corrected	Counts Attributed to		Raw		Corrected	Counts Attributed to		Raw	Corrected	Counts Attributed to			
	Daily	Adjust	Daily	Chum	Pink	Daily	Adjust	Daily	Chum	Pink	Daily	Daily	Chum Salmon		Pink Salmon	
Date	Estimate	Factor	Estimate	Salmon	Salmon	Estimate	Factor	Estimate	Salmon	Salmon	Estimate	Estimate	Daily	Cumulative	Daily	Cumulative
22-Jun [a]	139	0.48	67	67	0			11 [b]	11	0	139	78	78	78	0	0
23-Jun	1,028	1.80	1,849	1,849	0			301 [b]	301	0	1,028	2,150	2,150	2,228	0	0
24-Jun	1,010	1.85	1,872	1,872	0			305 [b]	305	0	1,010	2,177	2,177	4,405	0	0
25-Jun [c]	5,378	0.92	4,936	4,936	0	644	1.36	876	876	0	6,022	5,812	5,812	10,217	0	0
26-Jun	3,917	1.14	4,451	4,451	0	758	2.76	2,095	2,095	0	4,675	6,546	6,546	16,763	0	0
27-Jun	5,178	0.97	5,036	5,036	0	1,015	1.29	1,305	1,305	0	6,193	6,341	6,341	23,104	0	0
28-Jun	14,993	0.93	13,869	13,869	0	2,074	1.01	2,094	2,094	0	17,067	15,963	15,963	39,067	0	0
29-Jun	33,898	0.43	14,552	14,552	0	1,696	1.10	1,863	1,863	0	35,594	16,415	16,415	55,482	0	0
30-Jun	10,048	1.00	10,060	10,022	38	1,110	1.00	1,115	1,115	0	11,158	11,175	11,137	66,619	38	38
1-Jul	45,423	0.39	17,794	17,794	0			2,426 [b]	2,426	0	45,423	20,220	20,220	86,839	0	38
2-Jul	25,162	0.77	19,485	19,485	0			2,657 [b]	2,657	0	25,162	22,142	22,142	108,981	0	38
3-Jul	19,426	0.95	18,478	17,833	645	2,726	1.12	3,046	3,046	0	22,152	21,524	20,879	129,860	645	683
4-Jul	9,796	1.05	10,305	9,230	1,075	1,669	1.08	1,802	1,802	0	11,465	12,107	11,032	140,892	1,075	1,758
5-Jul	25,490	0.98	24,901	24,042	859	2,284	1.24	2,827	2,827	0	27,774	27,728	26,869	167,761	859	2,617
6-Jul	26,609	0.91	24,165	21,642	2,523	5,857	1.12	6,573	4,955	1,618	32,466	30,738	26,597	194,358	4,141	6,758
7-Jul	35,142	0.97	34,120	29,462	4,658	8,563	1.02	8,760	6,482	2,278	43,705	42,880	35,944	230,302	6,936	13,694
8-Jul	22,282	0.98	21,823	17,320	4,503	13,181	0.94	12,371	9,034	3,337	35,463	34,194	26,354	256,656	7,840	21,534
9-Jul			20,983 [b]	16,684	4,299	10,616	0.89	9,427	8,345	1,082	10,616	30,410	25,029	281,685	5,381	26,915
10-Jul	21,129	1.00	21,097	17,122	3,975	12,796	1.04	13,352	8,519	4,833	33,925	34,449	25,641	307,326	8,808	35,723
11-Jul	18,679	0.99	18,583	14,007	4,576	13,027	0.98	12,820	7,192	5,628	31,706	31,403	21,199	328,525	10,204	45,927
12-Jul	23,067	0.87	20,090	14,234	5,856	13,984	0.97	13,561	8,590	4,971	37,051	33,651	22,824	351,349	10,827	56,754
13-Jul	25,173	0.87	21,858	14,178	7,680	13,657	0.90	12,314	7,525	4,789	38,830	34,172	21,703	373,052	12,469	69,223
14-Jul	24,556	0.89	21,903	10,001	11,902	13,216	0.94	12,396	6,398	5,998	37,772	34,299	16,399	389,451	17,900	87,123
15-Jul	19,043	0.93	17,751	8,059	9,692	11,103	0.80	8,867	4,968	3,899	30,146	26,618	13,027	402,478	13,591	100,714
16-Jul	20,163	0.75	15,046	7,960	7,086	12,101	0.84	10,136	6,154	3,982	32,264	25,182	14,114	416,592	11,068	111,782
17-Jul			9,173 [b]	6,271	2,902	6,342	0.89	5,623	3,936	1,687	6,342	14,796	10,207	426,799	4,589	116,371
18-Jul	14,417	0.45	6,438	5,183	1,255	5,161	0.86	4,428	1,230	3,198	19,578	10,866	6,413	433,212	4,453	120,824
19-Jul	3,766	1.09	4,101	2,720	1,381	3,900	0.94	3,648	2,112	1,536	7,666	7,749	4,832	438,044	2,917	123,741
20-Jul	4,394	0.98	4,312	3,289	1,023	1,837	1.03	1,886	1,372	514	6,231	6,198	4,661	442,705	1,537	125,278
21-Jul	4,584	0.91	4,155	3,474	681	1,966	1.04	2,038	815	1,223	6,550	6,193	4,289	446,994	1,904	127,182
22-Jul	6,018	0.89	5,338	5,106	232	1,484	1.03	1,523	1,218	305	7,502	6,861	6,324	453,318	537	127,719
23-Jul			3,036 [b]	2,557	479	1,482	0.68	1,011	379	632	1,482	4,047	2,936	456,254	1,111	128,830
24-Jul [d]			4,092 [b]	2,046	2,046	1,234	1.11	1,364	758	606	1,234	5,456	2,804	459,058	2,652	131,482
Total	469,908		425,719	346,353	79,366	165,483		164,821	112,705	52,116	635,391	590,540	459,058		131,482	
Percent	74.0%		72.1%	75.4%	60.4%	26.0%		27.9%	24.6%	39.6%			100.0%		100.0%	
Mean		0.94					1.07									

[a] Right bank counting began at 17:00.

[b] Counts calculated based on proportion of opposite bank.

[c] Left bank counting began at 00:00.

[d] Counting ended at 24:00.

Table 6. Anvik River adjusted sonar estimated passage and proportions by hour and bank, 2002.

Hour	Right Bank		Left Bank		Proportion of the Run		
Ending	Count	Cum.	Count	Cum.	Right Bank	Left Bank	Total
0100	19,053	19,053	9,338	9,338	0.035	0.017	0.052
0200	20,677	39,730	8,853	18,191	0.038	0.016	0.054
0300	21,208	60,938	8,975	27,166	0.039	0.016	0.055
0400	20,431	81,369	7,091	34,257	0.037	0.013	0.050
0500	21,447	102,816	6,133	40,390	0.039	0.011	0.050
0600	23,899	126,714	6,422	46,811	0.044	0.012	0.055
0700	20,724	147,438	5,138	51,949	0.038	0.009	0.047
0800	19,323	166,761	5,147	57,096	0.035	0.009	0.045
0900	18,779	185,540	5,041	62,137	0.034	0.009	0.044
1000	17,278	202,819	4,890	67,027	0.032	0.009	0.040
1100	16,445	219,264	5,105	72,132	0.030	0.009	0.039
1200	14,501	233,765	4,544	76,676	0.026	0.008	0.035
1300	14,289	248,054	4,113	80,789	0.026	0.008	0.034
1400	13,484	261,538	4,492	85,281	0.025	0.008	0.033
1500	11,730	273,268	5,051	90,332	0.021	0.009	0.031
1600	10,204	283,473	4,946	95,279	0.019	0.009	0.028
1700	9,676	293,149	5,410	100,689	0.018	0.010	0.028
1800	10,080	303,229	5,953	106,642	0.018	0.011	0.029
1900	11,991	315,219	8,521	115,162	0.022	0.016	0.037
2000	12,918	328,138	7,919	123,081	0.024	0.014	0.038
2100	12,873	341,010	8,121	131,202	0.024	0.015	0.038
2200	12,577	353,588	9,610	140,812	0.023	0.018	0.041
2300	14,931	368,518	9,232	150,044	0.027	0.017	0.044
2400	19,917	388,435	9,072	159,117	0.036	0.017	0.053
Totals[a]		388,435		159,117	0.709	0.291	1.000

a Totals do not include periods with no data.

Table 7. Anvik River adjusted sonar estimated counts and proportions by sector and bank, 2002.

	Right Bank		Left Bank		Proportion of the Run		
Sector	Count	Cum.	Count	Cum.	Right Bank	Left Bank	Total
1	1,101	1,101	93	93	0.002	0.000	0.002
2	9,713	10,814	396	489	0.018	0.001	0.018
3	22,628	33,442	913	1,402	0.041	0.002	0.043
4	40,215	73,657	2,235	3,637	0.073	0.004	0.078
5	49,690	123,347	4,924	8,561	0.091	0.009	0.100
6	55,859	179,205	10,297	18,858	0.102	0.019	0.121
7	56,479	235,684	17,465	36,323	0.103	0.032	0.135
8	53,608	289,292	20,379	56,702	0.098	0.037	0.135
9	17,621	306,913	25,733	82,435	0.032	0.047	0.079
10	24,777	331,690	34,541	116,976	0.045	0.063	0.108
11	14,155	345,845	14,725	131,701	0.026	0.027	0.053
12	8,792	354,637	10,015	141,716	0.016	0.018	0.034
13	7,594	362,231	6,413	148,129	0.014	0.012	0.026
14	7,709	369,940	3,956	152,085	0.014	0.007	0.021
15	10,689	380,629	4,200	156,284	0.020	0.008	0.027
16	7,807	388,435	2,832	159,117	0.014	0.005	0.019
Total[a]	388,435		159,117		0.709	0.291	1.000

a Totals do not include periods with no data.

Table 8. Anvik River beach seine catch by species, sex, day, and stratum, and the number of chum salmon sampled for age, sex, and length information, 2002.

	Chum Salmon									Other Fish					
	Number Captured			Number Sampled			Number Aged			Salmon					
Date	Male	Female	Total	Male	Female	Total	Male	Female	Total	Pink	Chinook	Grayling	Whitefish	Dolly Varden	Other
25-Jun	13	13	26	5	11	16	5	10	15	1	0	2	9		1
29-Jun	26	28	54	26	28	54	24	23	47	1	0	5	10		
30-Jun	41	48	89	41	48	89	34	41	75	7	0	8	11		
Subtotal (Strata 1)	80	89	169	72	87	159	63	74	137	9	0	15	30	0	1
5-Jul	40	73	113	40	73	113	31	59	90	7	0	8	11		
Subtotal (Strata 2)	40	73	113	40	73	113	31	59	90	7	0	8	11	0	0
7-Jul	13	27	40	13	25	38	11	25	36	6	0	0	0		
11-Jul	24	42	66	24	39	63	22	35	57	31	3	5	3		
Subtotal (Strata 3)	37	69	106	37	64	101	33	60	93	37	3	5	3	0	0
13-Jul	22	32	54	22	32	54	20	31	51	55	3	8	15		
15-Jul	32	25	57	19	14	33	19	13	32	86	5	4	8		
21-Jul	16	37	53	13	37	50	11	32	43	22	1	16	14		
22-Jul	18	11	29	13	13	26	11	13	24	22	0	9	5		
Subtotal (Strata 4)	88	105	193	67	96	163	61	89	150	185	9	37	42	0	0
Season Total	245	336	581	216	320	536	188	282	470	238	12	65	86	0	

Table 9. Anvik River summer chum salmon escapement age and sex composition, and mean length (mm), 2002.

		Brood Year and Age Group				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Sample Size:	470					
Female	No. in Escapement	8,888	218,503	48,340	4,002	279,733
	Percent of Sample	1.9	47.6	10.5	0.9	60.9
	Mean Length	532.0	549.0	554.0	547.0	
	Std. Error	14.0	2.0	5.0	25.0	
Male	No. in Escapement	0	134,084	41,554	3,687	179,325
	Percent of Sample	0.0	29.2	9.1	0.8	39.1
	Mean Length	0.0	581.0	587.0	628.0	
	Std. Error	0.0	3.0	4.0	24.0	
Total	No. in Escapement	8,888	352,587	89,894	7,689	459,058
	Percent of Sample	1.9	76.8	19.6	1.7	100.0

Table 10. Anvik River climatological and hydrological observaitions at the sonar site, 2002.

					Temperature (C)			Water Height			
Date	Precipitation	Wind Direction	Velocity	Sky Code	Air Min.	Air Max.	Water Temp.	Actual (cm)	Relative (cm)	Water Color	Comments
20-Jun	O	---	---	1	---	---	---	38.1	0.0	Cl	Water gauge set at 15 inches.
21-Jun	O	Calm	0	1	8	24	15	30.5	-7.6	Cl	
22-Jun	O	North	5-10	1	6	22	14	26.7	-11.4	Cl	
23-Jun	O	North	10	1	6	18	15	20.3	-17.8	Cl	Nice day
24-Jun	O	Northwest	10-15	3	6	16	13	19.1	-19.1	Cl	Stormy - clear - breezy
25-Jun	O	Calm	0	3	8	18	14	15.9	-22.2	Cl	
26-Jun	I	Variable	5-10	4	3	18	14	15.2	-22.9	LT	Overcast
27-Jun	O	Calm	0	1	7	21	13	15.2	-22.9	Cl	
28-Jun	O	North	1-2	2	6	21	14	12.7	-25.4	Cl	
29-Jun	O	Northwest	5	3	6	20	14	10.2	-27.9	Cl	
30-Jun	O	Northwest	10	2	4	19	14	8.9	-29.2	Cl	
1-Jul	O	Calm	0	3	---	---	14	6.4	-31.8	Cl	Blustery early in day
2-Jul	O	Calm	0	2	6	21	13	4.4	-33.7	Cl	Clearing
3-Jul	O	Calm	5	1	4	20	10	4.4	-33.7	Cl	
4-Jul	I	North	5	4	0	19	10	4.4	-33.7	Cl	
5-Jul	O	Calm	0	3	-1	22	9	4.4	-33.7	Cl	
6-Jul	O	North	10	2	0	20	9	3.2	-34.9	Cl	
7-Jul	I	Northwest	5-10	3	9	18	11	3.8	-34.3	Cl	
8-Jul	I	Northwest	5	3	---	---	---	1.3	-36.8	Cl	
9-Jul	I	Calm	0	3	---	---	---	0.0	-38.1	Cl	
10-Jul	O	Calm	5	2	12	18	17	-2.5	-40.6	Cl	
11-Jul	O	Calm	5	4	18	24	14	-3.8	-41.9	Cl	
12-Jul	O	Calm	0	2	11	19	14	-5.1	-43.2	Cl	Hot and muggy
13-Jul	I	Northwest	5-10	4	12	20	14	1.3	-36.8	Cl	Reset water gage.
14-Jul	O	Calm	10	2	12	17	14	2.5	-35.6	Cl	
15-Jul	O	Calm	10	2	10	16	14	2.5	-35.6	Cl	
16-Jul	O	Calm	15	2	9	21	13	1.3	-36.8	Cl	Nice day
17-Jul	O	Northwest	10	2	11	26	17	0.0	-38.1	Cl	Too hot
18-Jul	I	Northwest	10	2	10	27	17	-1.3	-39.4	Cl	
19-Jul	O	Northwest	5	3	11	24	16	0.0	-38.1	Cl	
20-Jul	I	Northwest	5	2	7	21	15	-1.3	-39.4	Cl	
21-Jul	I	South	5-10	3	11	21	14	-2.5	-40.6	Cl	
22-Jul	I	Northwest	5-10	3	9	20	13	-3.8	-41.9	Cl	
23-Jul	O	North	10	3	11	21	13	-3.8	-41.9	Cl	

Weather Codes					
SKY		PRECIPITATION		WATER COLOR	
0	No observation made.	I	Intermittent rain	Cl	Clear
1	Clear sky, cloud cover < 10% of sky.	R	Continuous rain	Lt	Light Brown
2	Cloud cover 10% - 50% of sky.	S	Snow	Br	Brown
3	Cloud cover > 50% of sky.	S&R	Mixed snow and rain	Dk	Dark Brown
4	Completely overcast.	H	Hail	Tr	Turbid: murky or glacial
5	Fog or thick haze or smoke.	T	Thunder showers		

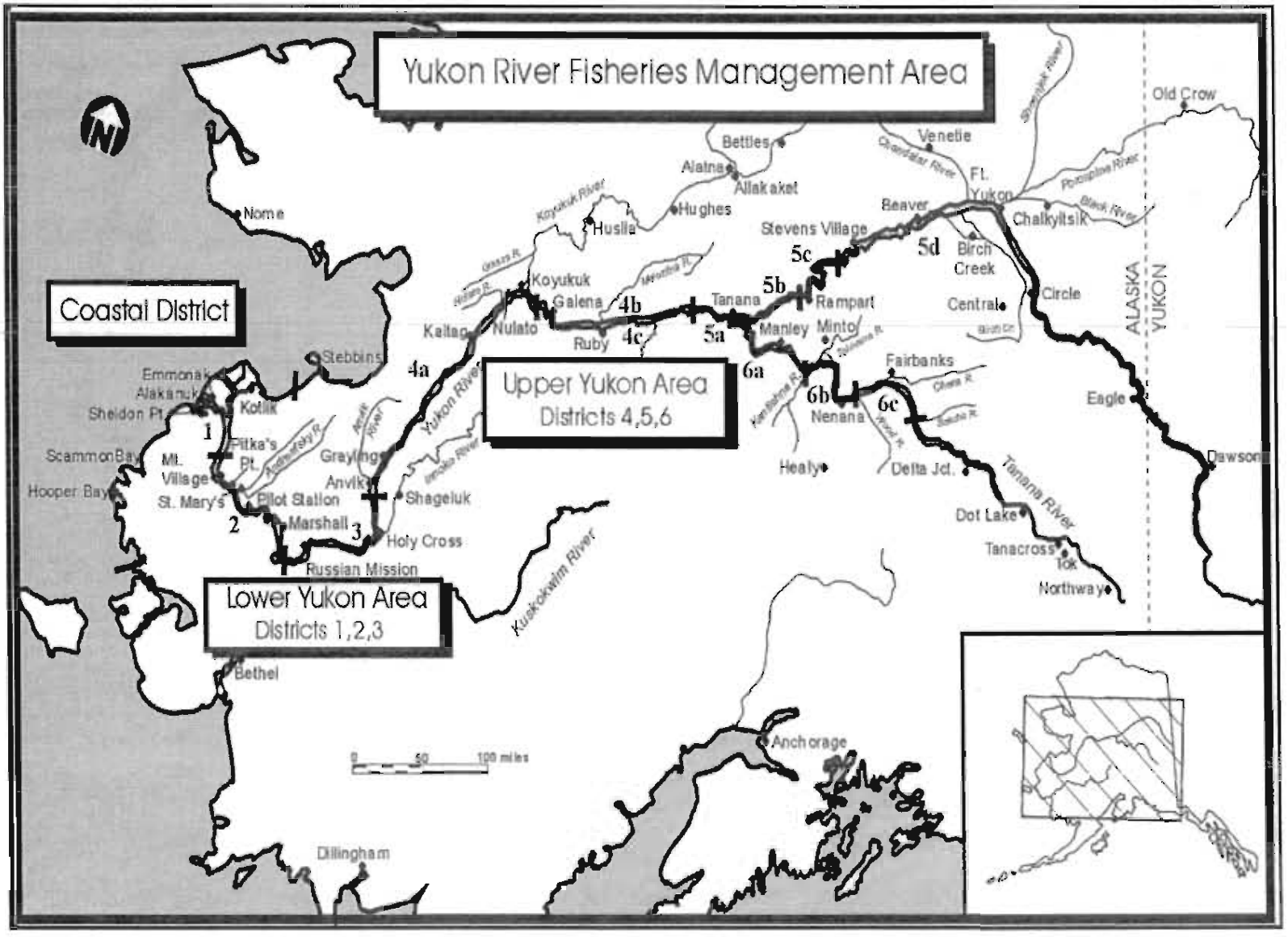


Figure 1. Alaska portion of the Yukon River drainage showing communities and fishing districts.

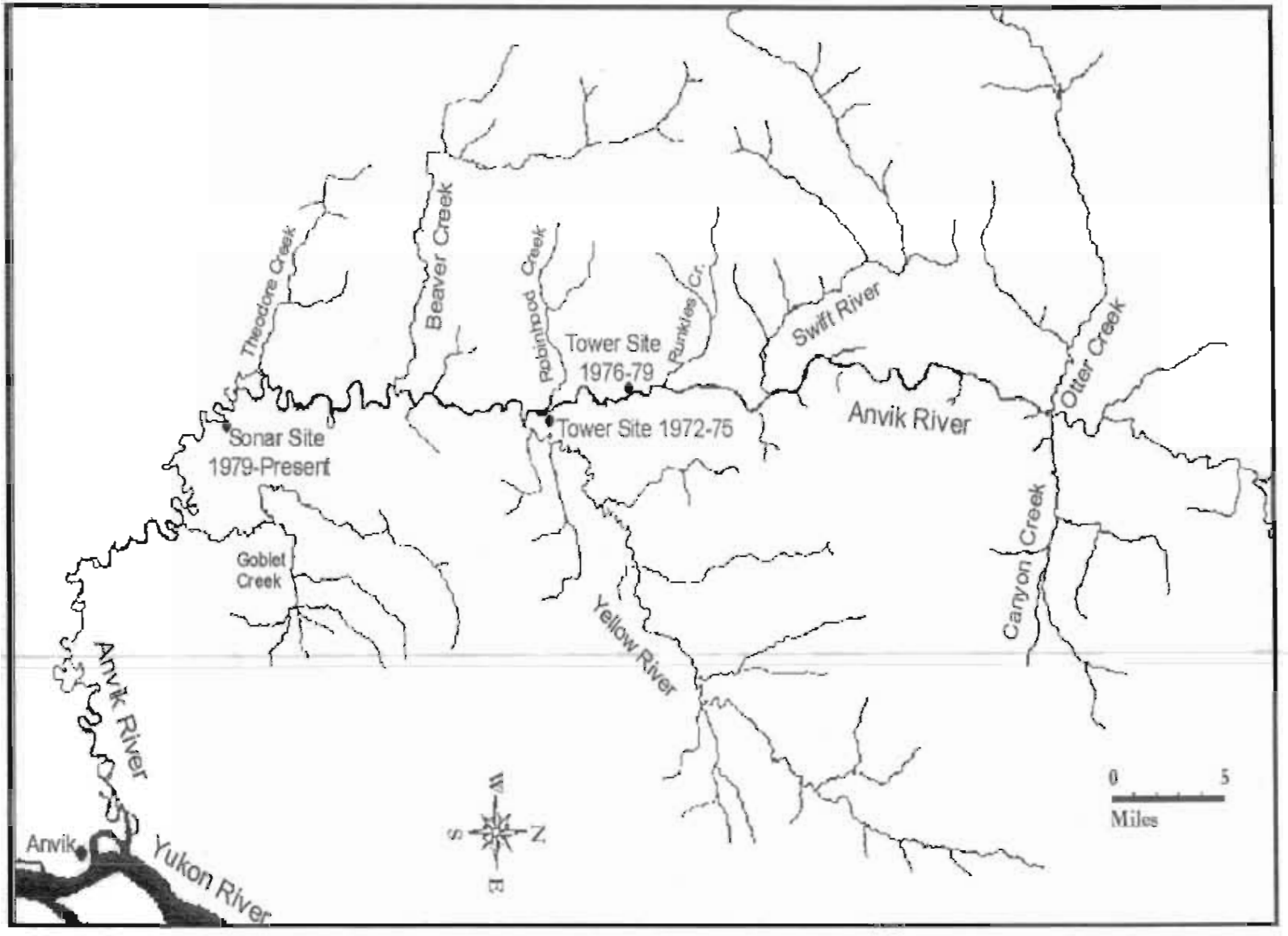


Figure 2. Map of the Anvik River drainage with historical chum salmon escapement project locations.

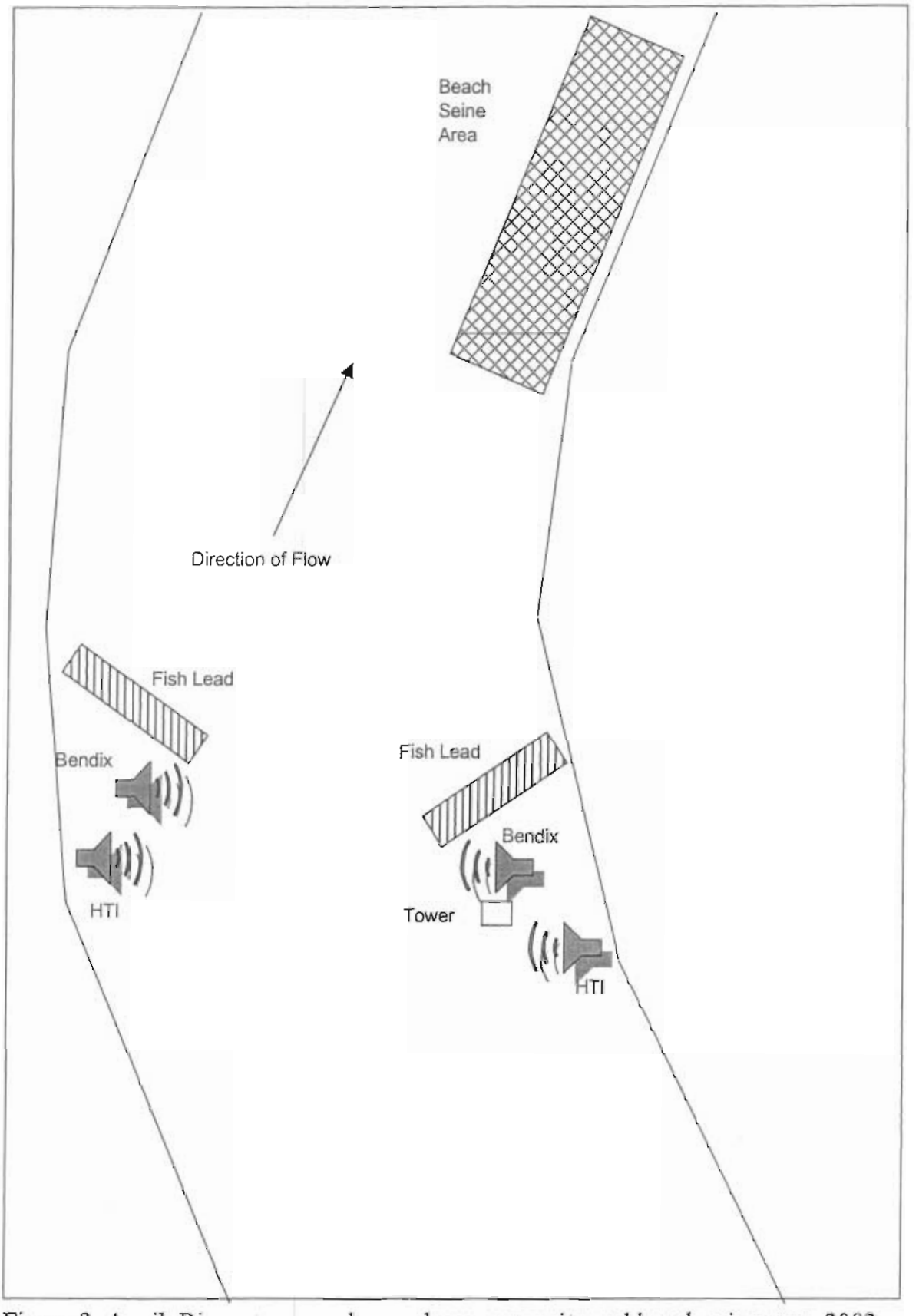
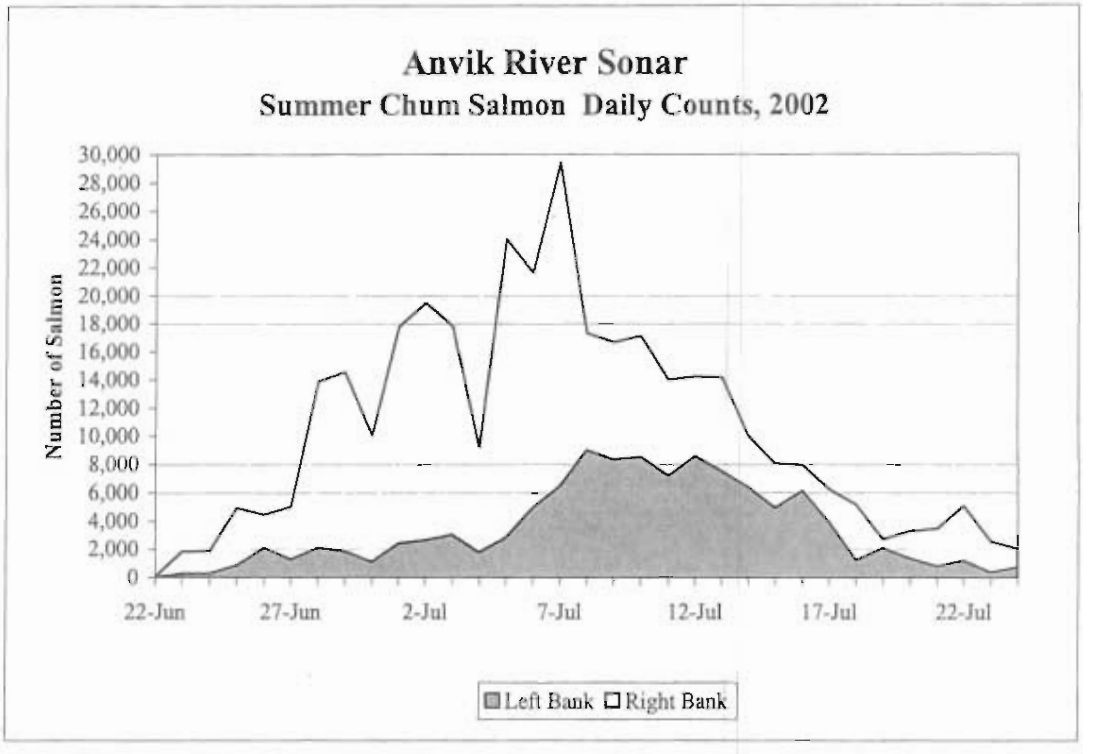


Figure 3. Anvik River summer chum salmon sonar site and beach seine area, 2002.



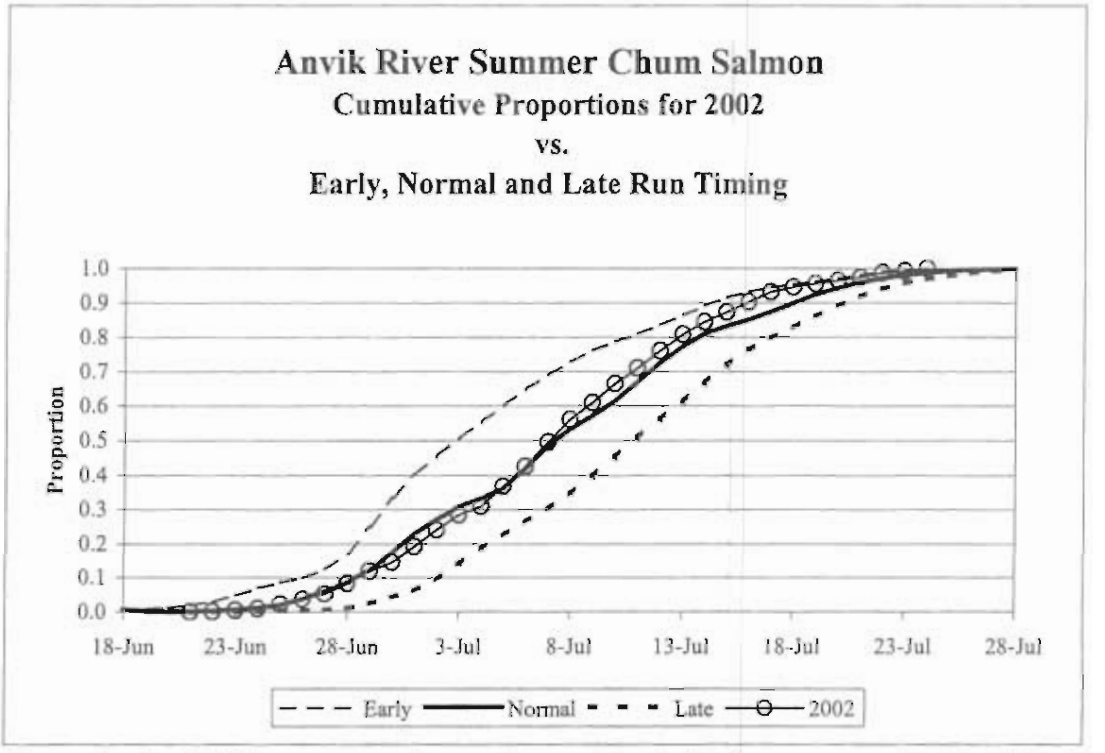


Figure 4. Anvik River summer chum salmon estimated daily escapement by bank (top) and the 2002 cumulative escapement proportions compared to Early, Normal and Late run timing based on historical run timing (bottom).

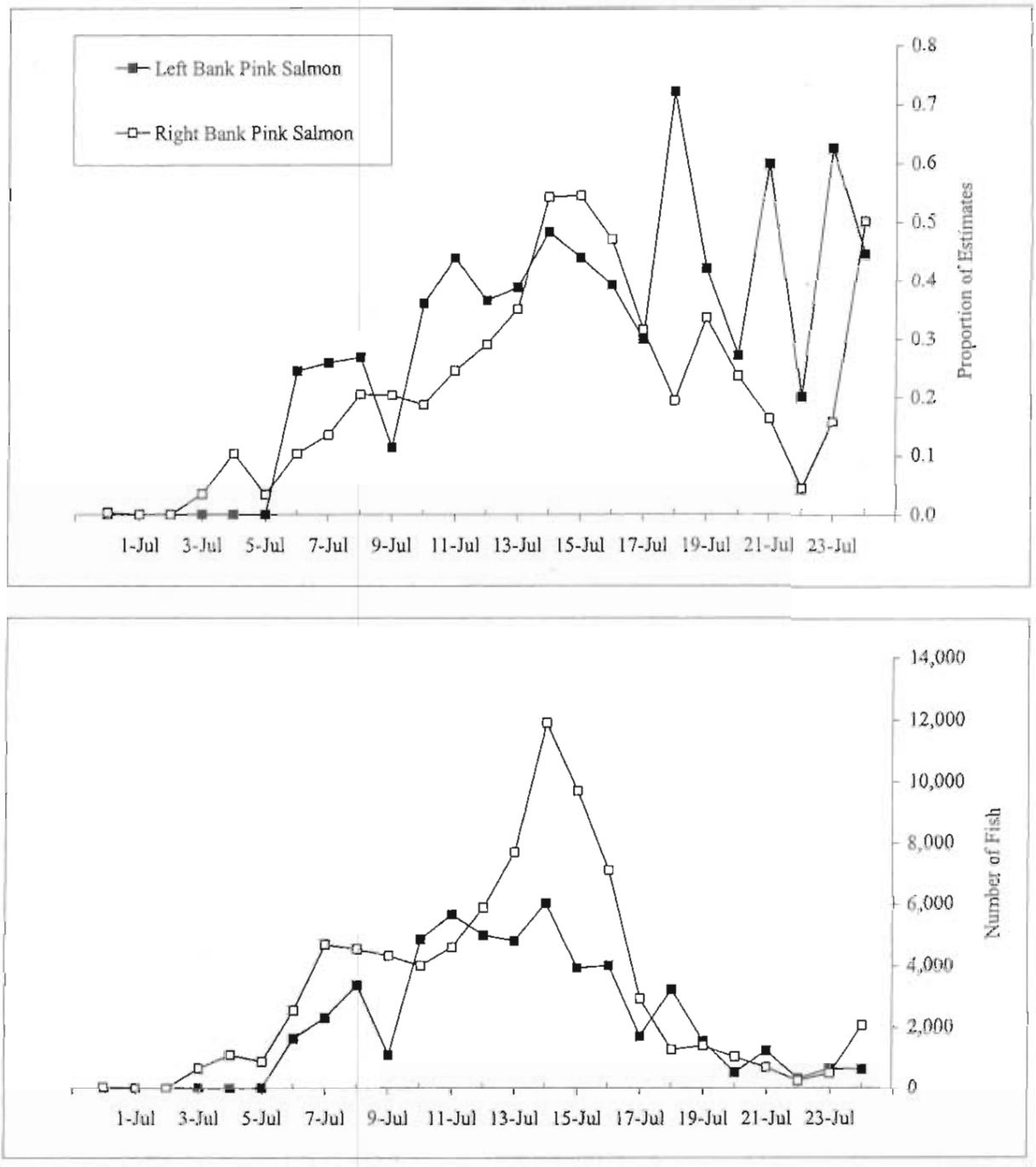
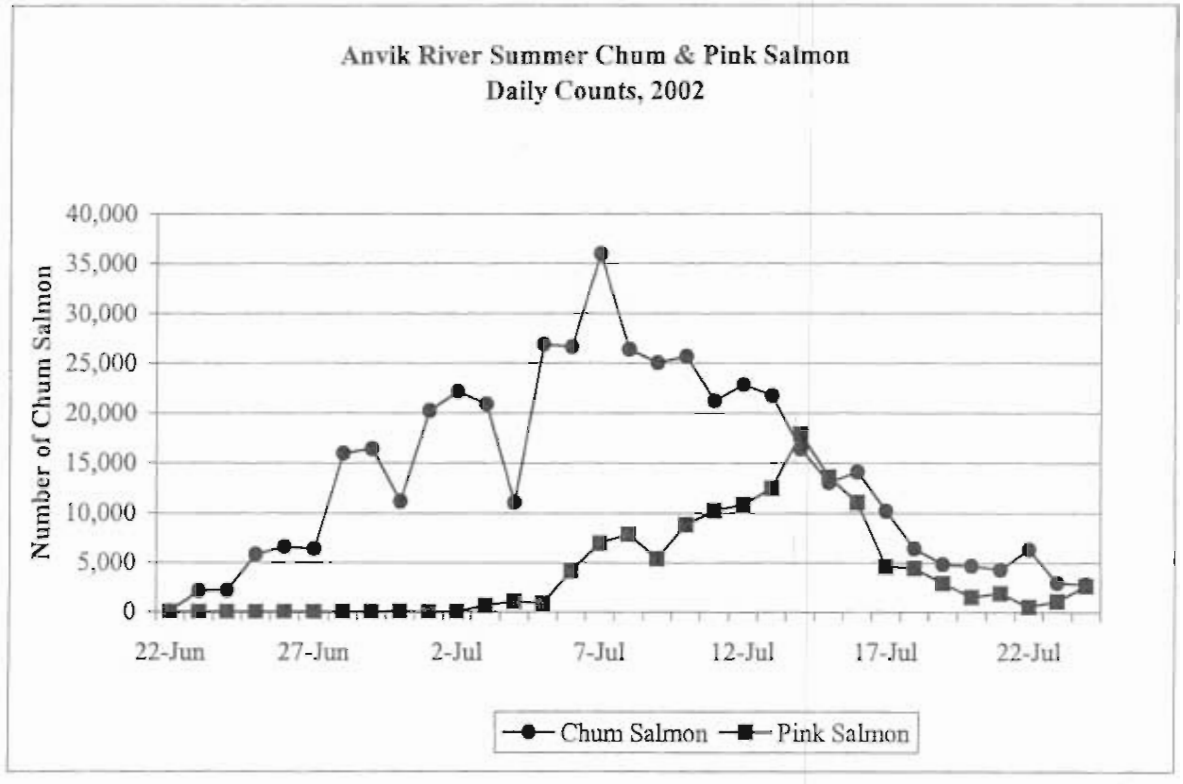


Figure 5. Anvik River daily pink salmon estimates by bank as a proportion of all salmon estimates (top), and as numbers of fish passing the sonar site (bottom), from 8 to 24 July, 2002.



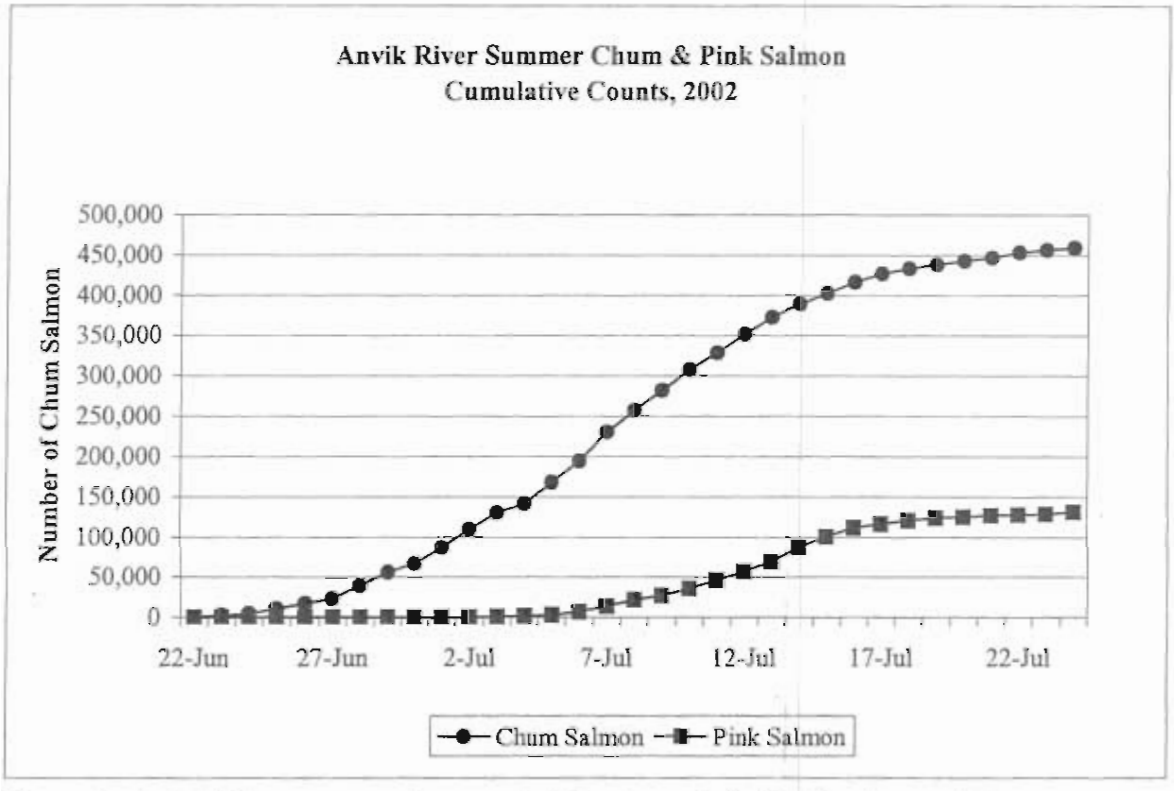


Figure 6. Anivk River summer chum and pink salmon daily (top) and cumulative escapement estimates (bottom), 2002.

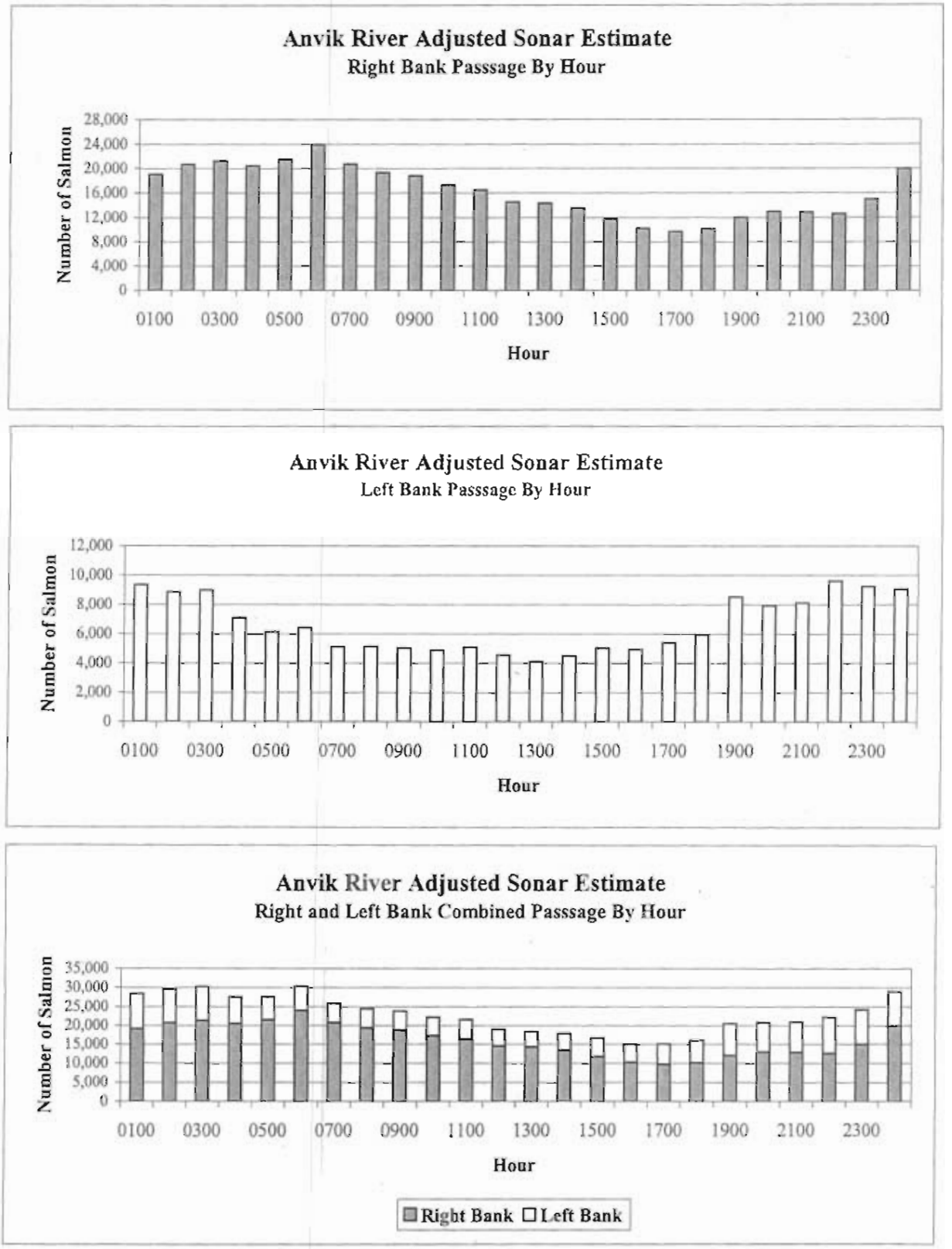


Figure 7. Anvik River adjusted sonar estimated passage by hour for right bank (top), left bank (middle) and both banks combined (bottom), 2002.

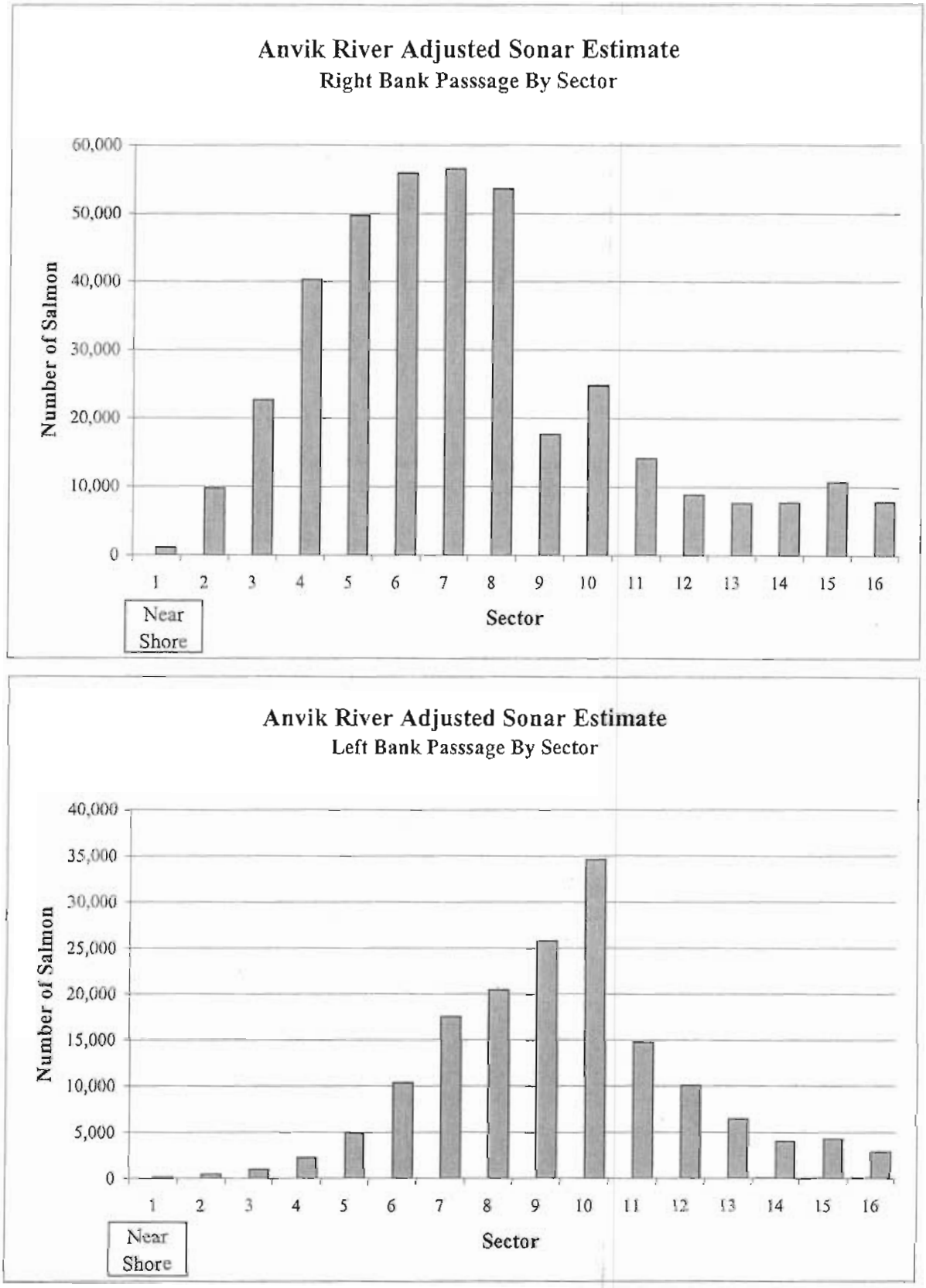
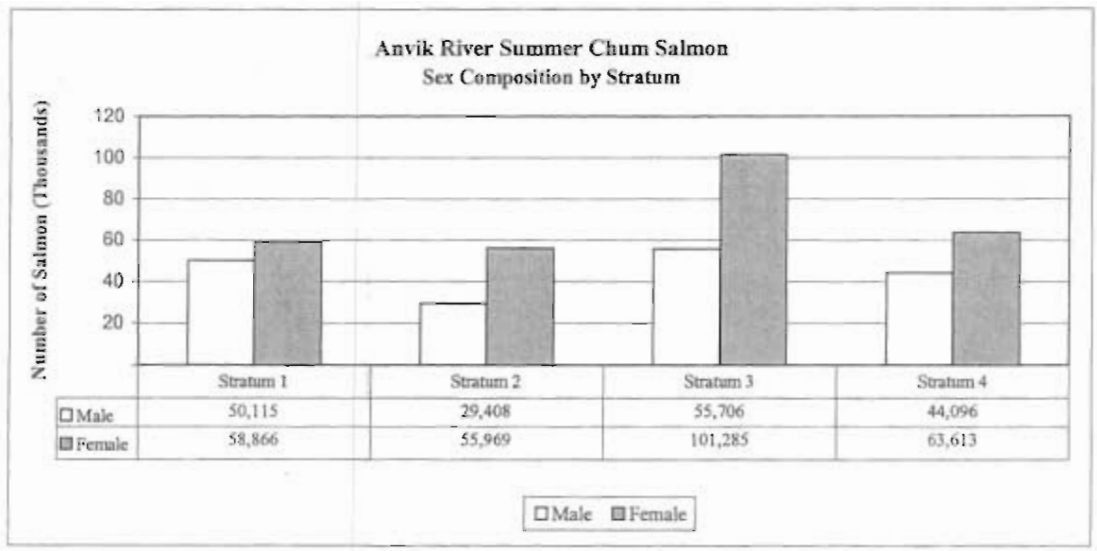
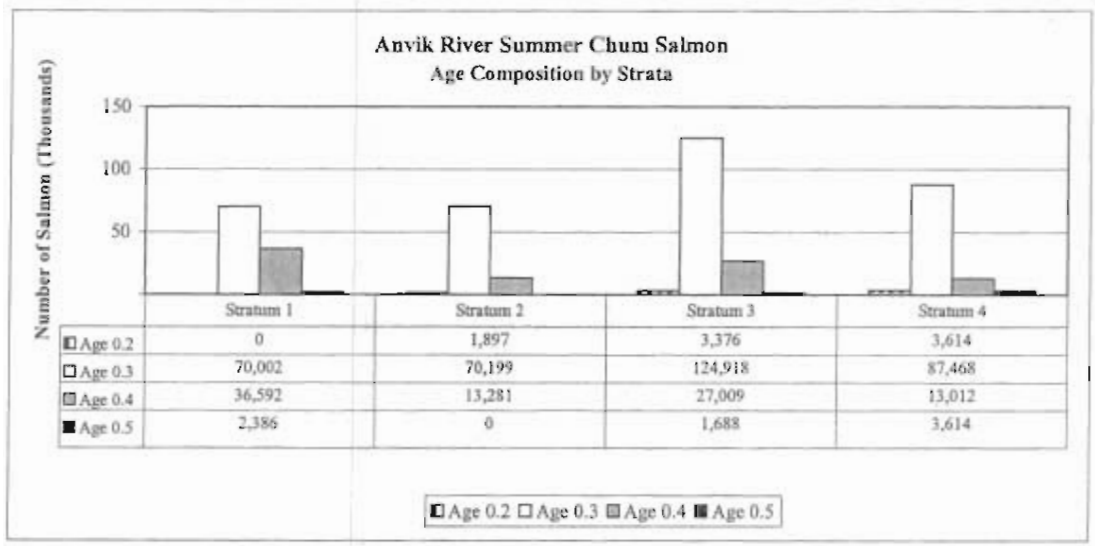


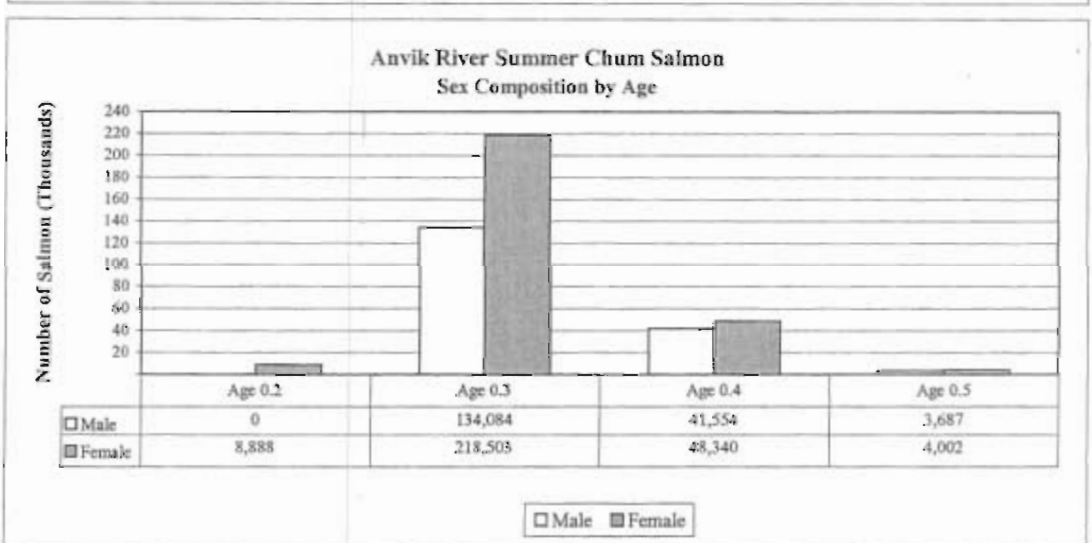
Figure 8. Anvik River adjusted sonar estimates by sector for right (top) and left bank (bottom), 2002.



	Stratum 1	Stratum 2	Stratum 3	Stratum 4
Male	50,115	29,408	55,706	44,096
Female	58,866	55,969	101,285	63,613

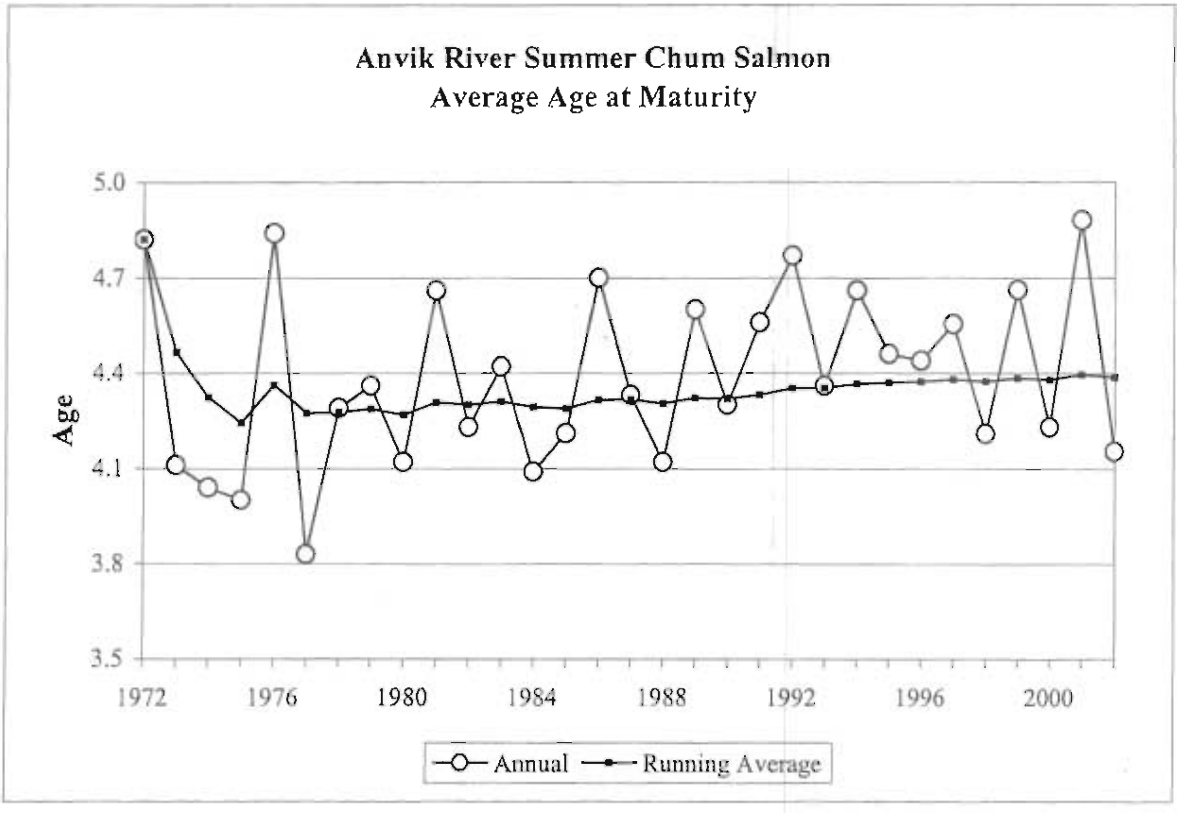


	Stratum 1	Stratum 2	Stratum 3	Stratum 4
Age 0.2	0	1,897	3,376	3,614
Age 0.3	70,002	70,199	124,918	87,468
Age 0.4	36,592	13,281	27,009	13,012
Age 0.5	2,386	0	1,688	3,614



	Age 0.2	Age 0.3	Age 0.4	Age 0.5
Male	0	134,084	41,554	3,687
Female	8,888	218,503	48,340	4,002

Figure 9. Anvik River summer chum salmon sex (top) and age (middle) composition by stratum, and sex composition by age group (bottom), 2002.



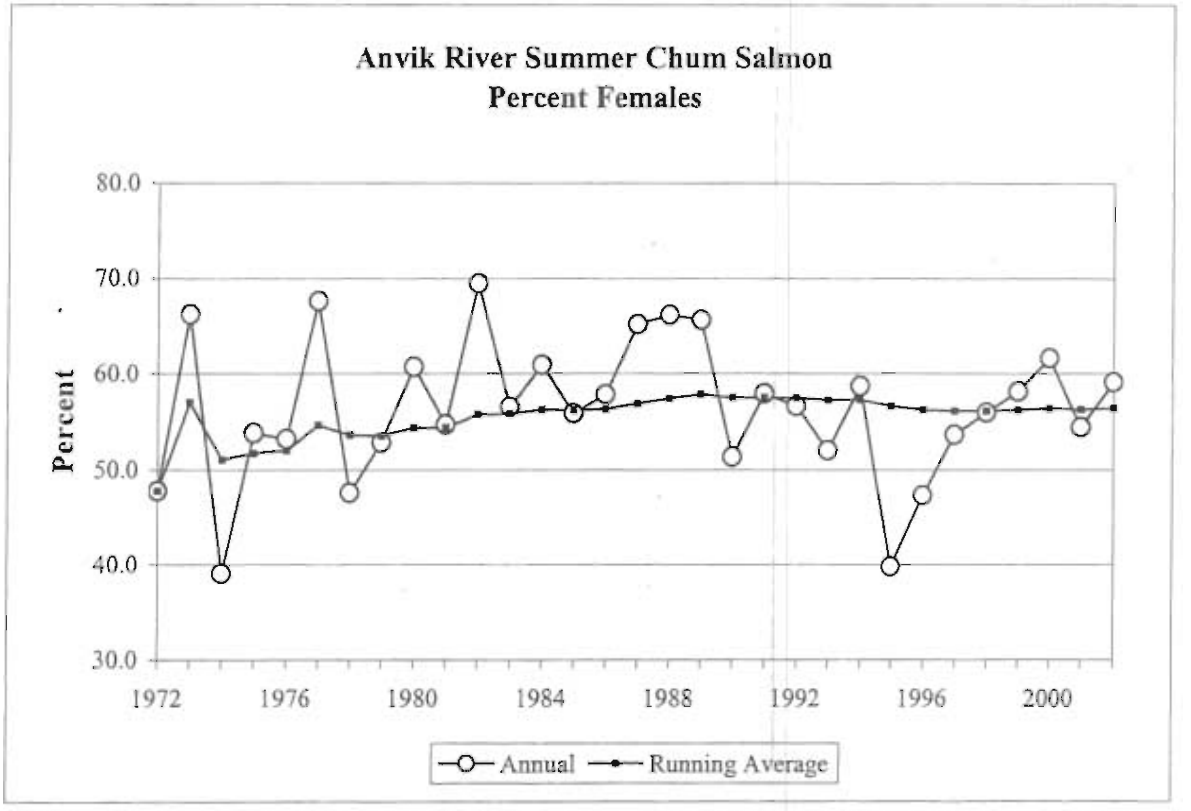
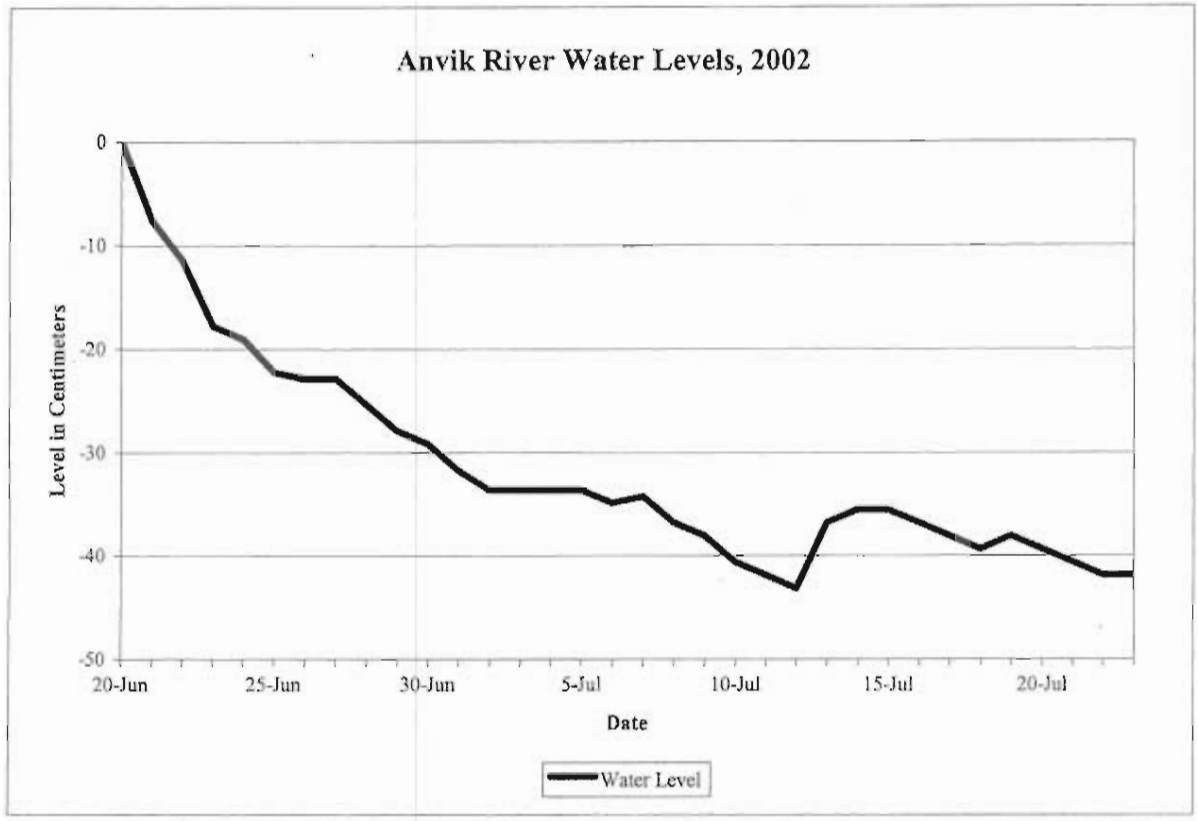


Figure 10. Average age at maturity (top) and percentage of females (bottom) of the Anvik River chum salmon escapement, 1972-2002.



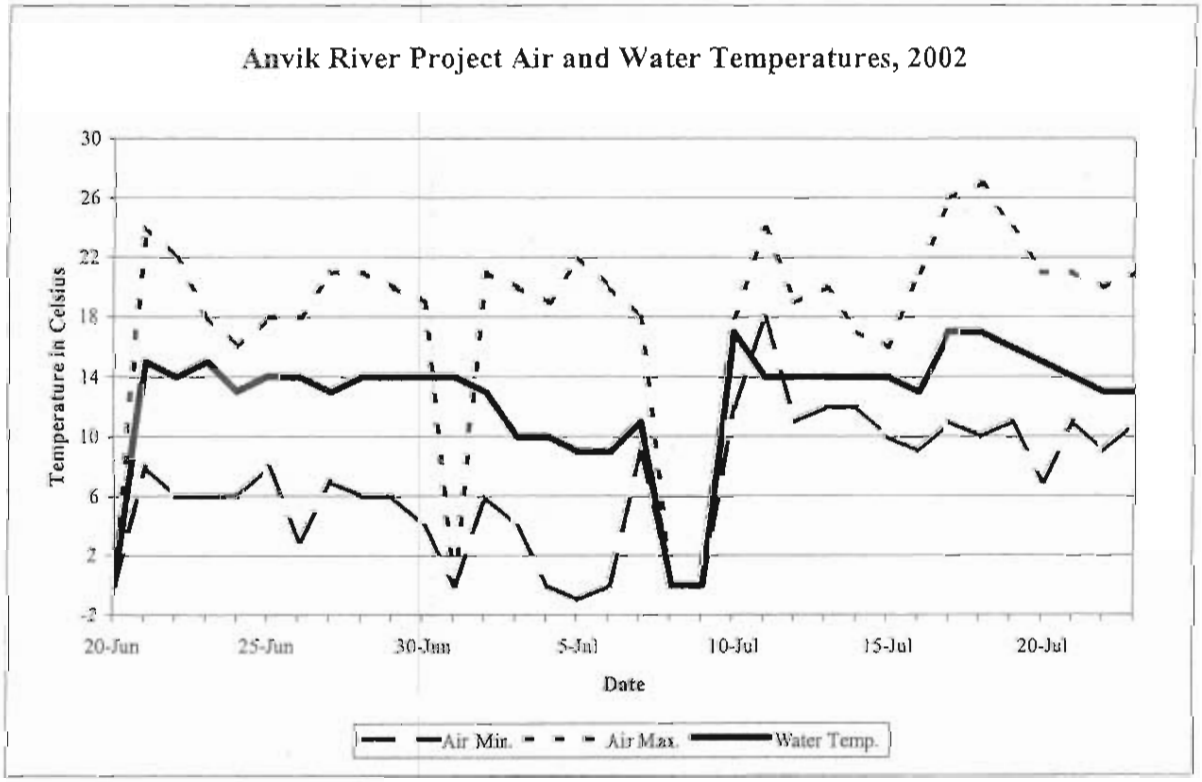


Figure 11. Anvik River hydrological (top) and climatological observations (bottom) at the sonar site, 2002.

Appendix Table A.1. Historic daily and cumulative Anvik River summer chum salmon estimated escapements, 1979-2002.

	1979		1980		1981		1982	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun								
19-Jun								
20-Jun					2,760	2,760		
21-Jun					5,795	8,555		
22-Jun					8,226	16,781		
23-Jun	813	813			54,097	70,878		
24-Jun	1,679	2,492			91,826	162,704		
25-Jun	1,549	4,041			115,356	278,060	715	715
26-Jun	1,926	5,967			82,910	360,970	2,436	3,151
27-Jun	5,639	11,606	839	839	44,491	405,461	6,026	9,177
28-Jun	8,469	20,075	3,688	4,527	36,737	442,198	3,744	12,921
29-Jun	11,232	31,307	7,604	12,131	111,356	553,554	3,669	16,590
30-Jun	18,211	49,518	17,528	29,659	69,581	623,135	4,445	21,035
1-Jul	14,692	64,210	25,744	55,403	89,992	713,127	3,795	24,830
2-Jul	11,503	75,713	22,123	77,526	80,312	793,439	3,762	28,592
3-Jul	15,027	90,740	11,898	89,424	76,740	870,179	9,671	38,263
4-Jul	13,178	103,918	9,105	98,529	88,481	958,660	23,642	61,905
5-Jul	12,433	116,351	17,000	115,529	78,032	1,036,692	22,454	84,359
6-Jul	11,667	128,018	16,809	132,338	42,931	1,079,623	22,261	106,620
7-Jul	8,718	136,736	10,877	143,215	40,410	1,120,033	14,333	120,953
8-Jul	11,578	148,314	19,080	162,295	25,856	1,145,889	27,291	148,244
9-Jul	10,454	158,768	18,442	180,737	28,654	1,174,543	40,527	188,771
10-Jul	21,370	180,138	31,980	212,717	36,015	1,210,558	25,882	214,653
11-Jul	16,770	196,908	29,926	242,643	61,612	1,272,170	19,988	234,641
12-Jul	22,118	219,026	17,757	260,400	38,459	1,310,629	36,197	270,838
13-Jul	13,709	232,735	23,542	283,942	18,149	1,328,778	33,836	304,674
14-Jul	10,114	242,849	30,746	314,688	20,979	1,349,757	33,232	337,906
15-Jul	8,612	251,461	33,689	348,377	30,072	1,379,829	18,757	356,663
16-Jul	7,449	258,910	29,092	377,469	23,569	1,403,398	13,672	370,335
17-Jul	4,375	263,285	23,053	400,522	15,523	1,418,921	14,982	385,317
18-Jul	2,751	266,036	29,042	429,564	7,766	1,426,687	12,970	398,287
19-Jul	2,810	268,846	19,761	449,325	9,809	1,436,496	11,402	409,689
20-Jul	2,705	271,551	14,676	464,001	9,922	1,446,418	7,566	417,255
21-Jul	3,436	274,987	8,117	472,118	6,041	1,452,459	7,455	424,710
22-Jul	1,276	276,263	6,202	478,320	6,397	1,458,856	5,352	430,062
23-Jul	1,449	277,712	814	479,134	10,063	1,468,919	4,685	434,747
24-Jul			1,450	480,584	5,078	1,473,997	5,530	440,277
25-Jul			1,597	482,181	2,885	1,476,882	2,167	442,444
26-Jul					1,709	1,478,591	2,137	444,581
27-Jul					991	1,479,582		
28-Jul								
29-Jul								
30-Jul								
Total	277,712		482,181		1,479,582		444,581	

(Continued)

Appendix Table A.1. Page 2 of 6.

	1983		1984		1985		1986	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun								
19-Jun								
20-Jun								
21-Jun	217	217					234	234
22-Jun	1,351	1,568	293	293			2,970	3,204
23-Jun	1,430	2,998	307	600			4,894	8,098
24-Jun	3,293	6,291	404	1,004			12,192	20,290
25-Jun	10,836	17,127	11,528	12,532			15,769	36,059
26-Jun	12,533	29,660	16,740	29,272			18,392	54,451
27-Jun	10,132	39,792	23,824	53,096			34,844	89,295
28-Jun	16,227	56,019	16,855	69,951			88,531	177,826
29-Jun	10,894	66,913	26,456	96,407			100,102	277,928
30-Jun	23,141	90,054	25,756	122,163			117,778	395,706
1-Jul	21,532	111,586	18,148	140,311			111,472	507,178
2-Jul	11,146	122,732	21,584	161,895			89,247	596,425
3-Jul	15,906	138,638	24,471	186,366			58,444	654,869
4-Jul	13,669	152,307	28,122	214,488			58,997	713,866
5-Jul	11,653	163,960	23,509	237,997	7,998	7,998	39,913	753,779
6-Jul	9,505	173,465	40,714	278,711	47,245	55,243	55,902	809,681
7-Jul	11,792	185,257	45,103	323,814	56,091	111,334	45,280	854,961
8-Jul	17,499	202,756	53,194	377,008	58,578	169,912	40,688	895,649
9-Jul	20,358	223,114	80,563	457,571	60,265	230,177	41,088	936,737
10-Jul	22,898	246,012	58,385	515,956	61,952	292,129	37,960	974,697
11-Jul	22,800	268,812	60,851	576,807	63,641	355,770	28,766	1,003,463
12-Jul	18,866	287,678	71,000	647,807	96,664	452,434	16,250	1,019,713
13-Jul	15,618	303,296	64,041	711,848	128,110	580,544	14,092	1,033,805
14-Jul	16,348	319,644	40,196	752,044	109,585	690,129	23,838	1,057,643
15-Jul	6,972	326,616	24,561	776,605	77,433	767,562	28,107	1,085,750
16-Jul	8,628	335,244	18,008	794,613	63,007	830,569		
17-Jul	10,300	345,544	13,343	807,956	44,349	874,918		
18-Jul	7,404	352,948	13,013	820,969	37,498	912,416		
19-Jul	4,460	357,408	16,347	837,316	27,196	939,612		
20-Jul	2,465	359,873	17,643	854,959	35,903	975,515		
21-Jul	1,745	361,618	11,666	866,625	27,103	1,002,618		
22-Jul	843	362,461	5,534	872,159	22,272	1,024,890		
23-Jul	451	362,912	7,532	879,691	14,768	1,039,658		
24-Jul			4,091	883,782	11,554	1,051,212		
25-Jul			2,325	886,107	10,031	1,061,243		
26-Jul			2,841	888,948	8,133	1,069,376		
27-Jul			2,080	891,028	5,977	1,075,353		
28-Jul					4,890	1,080,243		
29-Jul								
30-Jul								
Total	362,912		891,028		1,080,243		1,085,750	

(Continued)

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	1987		1988		1989		1990	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun								
19-Jun								
20-Jun					162	162		
21-Jun	202	202	2,503	2,503	497	659		
22-Jun	339	541	1,092	3,595	2,244	2,903	158	158
23-Jun	425	966	1,841	5,436	4,919	7,822	1,515	1,673
24-Jun	467	1,433	1,853	7,289	5,258	13,080	1,603	3,276
25-Jun	605	2,038	5,264	12,553	7,268	20,348	1,838	5,114
26-Jun	1,586	3,624	9,187	21,740	7,353	27,701	7,419	12,533
27-Jun	3,043	6,667	24,682	46,422	17,792	45,493	14,742	27,275
28-Jun	3,731	10,398	57,538	103,960	21,632	67,125	5,830	33,105
29-Jun	6,401	16,799	96,842	200,802	33,533	100,658	15,800	48,905
30-Jun	14,571	31,370	84,240	285,042	36,228	136,886	19,919	68,824
1-Jul	8,637	40,007	94,566	379,608	37,460	174,346	26,093	94,917
2-Jul	13,065	53,072	104,891	484,499	33,743	208,089	25,566	120,483
3-Jul	14,974	68,046	73,286	557,785	29,033	237,122	22,724	143,207
4-Jul	21,226	89,272	57,432	615,217	24,058	261,180	12,268	155,475
5-Jul	25,487	114,759	60,081	675,298	25,797	286,977	24,385	179,860
6-Jul	36,536	151,295	68,021	743,319	22,668	309,645	16,799	196,659
7-Jul	25,139	176,434	40,829	784,148	23,907	333,552	11,987	208,646
8-Jul	16,094	192,528	42,795	826,943	28,232	361,784	11,669	220,315
9-Jul	6,074	198,602	46,130	873,073	27,763	389,547	12,419	232,734
10-Jul	11,533	210,135	25,614	898,687	20,790	410,337	11,197	243,931
11-Jul	11,624	221,759	23,131	921,818	21,804	432,141	28,262	272,193
12-Jul	13,444	235,203	30,350	952,168	28,737	460,878	14,091	286,284
13-Jul	23,464	258,667	30,468	982,636	33,821	494,699	6,170	292,454
14-Jul	29,136	287,803	26,287	1,008,923	26,856	521,555	4,872	297,326
15-Jul	35,855	323,658	27,474	1,036,397	30,602	552,157	3,535	300,861
16-Jul	28,964	352,622	15,922	1,052,319	17,803	569,960	5,673	306,534
17-Jul	15,179	367,801	5,340	1,057,659	5,003	574,963	11,394	317,928
18-Jul	13,744	381,545	12,676	1,070,335	10,460	585,423	7,304	325,232
19-Jul	13,599	395,144	11,987	1,082,322	10,035	595,458	7,535	332,767
20-Jul	16,658	411,802	5,382	1,087,704	10,872	606,330	10,970	343,737
21-Jul	13,530	425,332	7,000	1,094,704	8,299	614,629	10,280	354,017
22-Jul	9,148	434,480	5,323	1,100,027	5,300	619,929	11,819	365,836
23-Jul	8,301	442,781	5,460	1,105,487	5,490	625,419	10,739	376,575
24-Jul	6,518	449,299	6,264	1,111,751	3,366	628,785	10,662	387,237
25-Jul	3,813	453,112	8,105	1,119,856	3,827	632,612	3,403	390,640
26-Jul	2,764	455,876	4,378	1,124,234	4,294	636,906	3,663	394,303
27-Jul			1,215	1,125,449			3,181	397,484
28-Jul							2,724	400,208
29-Jul							2,216	402,424
30-Jul							1,203	403,627
Total	455,876		1,125,449		636,906		403,627	

(Continued)

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	1991		1992		1993		1994	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun								
19-Jun					185	185	279	279
20-Jun					1,068	1,253	1,392	1,671
21-Jun	22	22	0	0	10,606	11,859	2,316	3,987
22-Jun	112	134	0	0	5,564	17,423	2,489	6,476
23-Jun	1,652	1,786	0	0	5,348	22,771	9,694	16,170
24-Jun	2,279	4,065	0	0	2,240	25,011	16,985	33,155
25-Jun	8,263	12,328	0	0	1,215	26,226	26,789	59,944
26-Jun	22,209	34,537	0	0	4,916	31,142	38,879	98,823
27-Jun	27,704	62,241	0	0	4,969	36,111	32,807	131,630
28-Jun	44,919	107,160	0	0	3,703	39,814	24,563	156,193
29-Jun	40,384	147,544	121	121	2,186	42,000	16,679	172,872
30-Jun	26,729	174,273	4,807	4,928	5,302	47,302	40,910	213,782
1-Jul	27,946	202,219	20,059	24,987	11,294	58,596	75,582	289,364
2-Jul	25,607	227,826	41,940	66,927	17,247	75,843	50,288	339,652
3-Jul	20,499	248,325	56,972	123,899	14,622	90,465	38,322	377,974
4-Jul	22,438	270,763	60,901	184,800	21,548	112,013	24,661	402,635
5-Jul	18,578	289,341	81,125	265,925	19,782	131,795	54,242	456,877
6-Jul	13,939	303,280	60,959	326,884	18,380	150,175	52,855	509,732
7-Jul	13,887	317,167	52,314	379,198	21,856	172,031	51,181	560,913
8-Jul	38,260	355,427	57,138	436,336	12,183	184,214	84,341	645,254
9-Jul	58,068	413,495	59,744	496,080	17,018	201,232	57,076	702,330
10-Jul	45,739	459,234	41,593	537,673	26,667	227,899	71,095	773,425
11-Jul	45,295	504,529	30,892	568,565	20,962	248,861	88,585	862,010
12-Jul	33,138	537,667	28,065	596,630	28,977	277,838	45,795	907,805
13-Jul	32,539	570,206	26,358	622,988	20,952	298,790	33,023	940,828
14-Jul	29,932	600,138	19,458	642,446	16,878	315,668	28,019	968,847
15-Jul	26,330	626,468	17,755	660,201	19,859	335,527	18,002	986,849
16-Jul	23,180	649,648	15,873	676,074	18,692	354,219	13,468	1,000,317
17-Jul	23,252	672,900	20,765	696,839	25,152	379,371	25,032	1,025,349
18-Jul	17,176	690,076	12,025	708,864	26,508	405,879	27,190	1,052,539
19-Jul	13,163	703,239	9,854	718,718	21,339	427,218	26,148	1,078,687
20-Jul	17,168	720,407	7,282	726,000	22,573	449,791	11,762	1,090,449
21-Jul	20,051	740,458	11,563	737,563	19,510	469,301	7,412	1,097,861
22-Jul	26,610	767,068	9,928	747,491	11,351	480,652	14,192	1,112,053
23-Jul	28,801	795,869	11,314	758,805	6,779	487,431	12,636	1,124,689
24-Jul	21,070	816,939	9,002	767,807	5,903	493,334		
25-Jul	17,231	834,170	7,819	775,626	9,187	502,521		
26-Jul	13,602	847,772			8,076	510,597		
27-Jul					6,812	517,409		
28-Jul								
29-Jul								
30-Jul								
Total	847,772		775,626		517,409		1,124,689	

(Continued)

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	1995		1996		1997		1998	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun			10,213	10,213				
19-Jun	395	395	4,615	14,828	561	561		
20-Jun	3,648	4,043	16,836	31,664	5,761	6,321		
21-Jun	5,831	9,874	43,565	75,229	8,403	14,724	1	1
22-Jun	11,639	21,513	34,257	109,486	5,072	19,796	164	165
23-Jun	6,459	27,972	50,000	159,486	22,395	42,191	1,202	1,367
24-Jun	8,723	36,695	63,193	222,679	29,758	71,949	2,103	3,471
25-Jun	15,302	51,997	28,156	250,835	23,643	95,592	3,175	6,646
26-Jun	9,389	61,386	35,303	286,138	7,181	102,773	4,161	10,807
27-Jun	36,645	98,031	46,390	332,528	19,719	122,493	4,721	15,528
28-Jun	78,678	176,709	34,348	366,876	29,291	151,784	4,210	19,738
29-Jun	87,951	264,660	33,115	399,991	36,752	188,536	4,868	24,606
30-Jun	52,897	317,557	45,936	445,927	31,248	219,783	8,063	32,669
1-Jul	53,297	370,854	58,459	504,386	32,374	252,157	14,597	47,266
2-Jul	82,228	453,082	55,211	559,597	28,963	281,120	14,835	62,101
3-Jul	59,206	512,288	39,335	598,932	28,931	310,051	24,539	86,640
4-Jul	27,695	539,983	44,112	643,044	26,746	336,797	22,857	109,496
5-Jul	50,642	590,625	61,740	704,784	26,575	363,372	25,589	135,085
6-Jul	105,422	696,047	38,482	743,266	20,109	383,481	34,503	169,588
7-Jul	105,992	802,039	49,067	792,333	24,365	407,847	35,114	204,702
8-Jul	55,108	857,147	34,221	826,554	24,356	432,202	16,755	221,457
9-Jul	38,646	895,793	23,194	849,748	15,851	448,054	14,740	236,196
10-Jul	60,116	955,909	18,093	867,841	13,710	461,764	20,959	257,156
11-Jul	64,070	1,019,979	10,579	878,420	11,550	473,315	27,179	284,335
12-Jul	41,220	1,061,199	13,038	891,458	7,663	480,977	35,455	319,790
13-Jul	39,638	1,100,837	12,871	904,329	4,803	485,780	35,331	355,121
14-Jul	33,743	1,134,580	10,077	914,406	8,467	494,246	20,702	375,822
15-Jul	39,977	1,174,557	7,411	921,817	12,436	506,683	8,195	384,017
16-Jul	30,640	1,205,197	7,173	928,990	15,943	522,626	18,556	402,574
17-Jul	24,950	1,230,147	4,250	933,240	12,682	535,308	14,564	417,138
18-Jul	25,638	1,255,785			13,040	548,348	12,179	429,318
19-Jul	16,814	1,272,599			14,631	562,979	16,685	446,003
20-Jul	26,622	1,299,221			12,826	575,806	11,525	457,528
21-Jul	19,154	1,318,375			11,684	587,490	10,702	468,230
22-Jul	11,735	1,330,110			10,177	597,667	10,020	478,250
23-Jul	5,982	1,336,092			4,701	602,368	6,082	484,332
24-Jul	3,326	1,339,418			3,384	605,752	2,969	487,301
25-Jul								
26-Jul								
27-Jul								
28-Jul								
29-Jul								
30-Jul								
Total	1,339,418		933,240		605,752		487,301	

(Continued)

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	1999		2000		2001		2002	
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
18-Jun								
19-Jun								
20-Jun								
21-Jun			10	10			78	78
22-Jun			9	19			2,150	2,228
23-Jun			28	47			2,177	4,405
24-Jun			25	72			5,812	10,217
25-Jun			49	121			6,546	16,763
26-Jun			49	170	671	671	6,341	23,104
27-Jun	85	85	218	388	445	1,115	15,963	39,067
28-Jun	274	359	97	485	951	2,066	16,415	55,482
29-Jun	1,546	1,905	104	589	2,109	4,175	11,137	66,619
30-Jun	3,176	5,081	2,167	2,756	6,208	10,383	20,220	86,839
1-Jul	10,336	15,417	5,174	7,930	3,661	14,045	22,142	108,981
2-Jul	11,038	26,455	6,427	14,357	3,671	17,716	20,879	129,860
3-Jul	15,497	41,952	6,369	20,727	12,503	30,219	11,032	140,892
4-Jul	20,660	62,612	3,904	24,631	10,098	40,317	26,869	167,761
5-Jul	31,112	93,724	4,457	29,088	9,180	49,497	26,597	194,358
6-Jul	27,755	121,479	7,322	36,410	8,769	58,266	35,944	230,302
7-Jul	33,489	154,968	9,465	45,875	7,171	65,438	26,354	256,656
8-Jul	28,502	183,470	14,495	60,370	13,328	78,766	25,029	281,685
9-Jul	22,090	205,560	17,712	78,082	11,735	90,500	25,641	307,326
10-Jul	28,185	233,745	15,124	93,206	22,636	113,137	21,199	328,525
11-Jul	21,647	255,392	23,105	116,311	12,901	126,038	22,824	351,349
12-Jul	17,370	272,761	19,212	135,523	11,241	137,279	21,703	373,052
13-Jul	15,215	287,976	11,882	147,405	11,751	149,029	16,399	389,451
14-Jul	13,615	301,591	4,334	151,739	11,810	160,839	13,027	402,478
15-Jul	13,034	314,626	10,464	162,202	11,286	172,125	14,114	416,592
16-Jul	17,692	332,318	7,362	169,565	7,773	179,898	10,207	426,799
17-Jul	14,841	347,159	4,816	174,380	7,944	187,842	6,413	433,212
18-Jul	13,842	361,001	3,750	178,130	5,193	193,035	4,832	438,044
19-Jul	15,313	376,314	4,384	182,515	6,173	199,208	4,661	442,705
20-Jul	13,196	389,511	3,244	185,758	6,816	206,024	4,289	446,994
21-Jul	12,888	402,398	1,706	187,464	4,446	210,471	6,324	453,318
22-Jul	8,474	410,873	1,318	188,782	4,072	214,543	2,936	456,254
23-Jul	8,485	419,358	1,567	190,349	2,264	216,806	2,804	459,058
24-Jul	6,452	425,810	1,255	191,604	1,992	218,798		
25-Jul	4,484	430,294	907	192,510	2,197	220,995		
26-Jul	2,465	432,759	1,102	193,612	1,496	222,491		
27-Jul	2,747	435,506	1,569	195,181	725	223,216		
28-Jul	1,850	437,356	1,168	196,349	843	224,058		
29-Jul								
30-Jul								
Total	437,356		196,349		224,058		459,058	

Appendix Table B.1. Right bank Anvik River adjusted sonar estimates by hour and sector, 2002.

Hour	Sector																	Total
Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total[a]	Adjusted[a]
100	40	511	1,419	2,349	2,727	3,420	3,633	3,940	1,004	1,452	990	566	387	372	442	316	23,568	19,053
200	76	883	2,454	2,715	2,806	4,398	4,754	4,720	1,360	1,807	862	484	414	550	831	422	29,536	20,677
300	133	1,376	2,506	3,201	3,378	4,372	5,188	5,004	1,001	1,230	862	476	431	555	888	561	31,162	21,208
400	97	1,591	2,647	3,005	3,106	4,418	4,774	5,957	761	1,149	678	394	392	454	1,143	760	31,326	20,431
500	70	776	1,732	3,215	3,416	4,883	5,598	5,670	1,042	1,333	842	529	443	564	1,031	523	31,667	21,447
600	124	904	1,687	3,355	3,892	5,607	4,534	6,616	1,189	1,649	959	559	414	431	566	440	32,926	23,899
700	31	852	1,405	2,280	2,736	5,499	3,905	5,108	1,153	1,600	887	553	383	370	417	274	27,453	20,724
800	37	562	1,240	1,830	2,423	2,994	3,059	2,801	986	1,450	930	512	432	411	562	319	20,548	19,323
900	59	521	1,181	1,993	2,429	3,131	2,978	2,839	885	1,309	682	440	303	344	448	405	19,947	18,779
1000	48	400	883	1,611	2,366	2,717	2,964	2,480	851	1,322	706	444	341	344	404	371	18,252	17,278
1100	19	276	750	1,365	2,064	2,488	2,849	2,647	862	1,258	651	422	350	383	605	412	17,401	16,445
1200	37	257	496	1,237	1,772	2,157	2,463	2,241	731	1,321	785	533	350	301	424	338	15,443	14,501
1300	31	225	547	1,269	1,866	2,087	2,329	2,249	905	1,105	634	392	373	335	378	363	15,088	14,289
1400	49	272	705	1,592	2,598	1,971	1,974	1,838	610	986	511	376	393	274	391	298	14,838	13,484
1500	42	342	941	1,618	1,798	1,701	1,740	1,428	627	906	546	340	189	222	263	245	12,948	11,730
1600	72	335	774	1,519	1,561	1,700	1,466	1,128	478	855	409	250	164	186	243	263	11,403	10,204
1700	100	399	894	1,328	1,499	1,430	1,450	1,069	418	679	507	302	258	257	279	329	11,198	9,676
1800	22	267	687	1,872	1,604	1,563	1,402	1,051	466	644	381	249	289	281	414	309	11,501	10,080
1900	12	310	783	1,634	1,949	1,704	1,612	1,471	970	893	512	359	343	375	360	294	13,581	11,991
2000	37	249	693	1,421	2,094	2,205	1,885	1,446	813	972	596	438	422	409	384	340	14,404	12,918
2100	63	256	587	1,482	2,039	2,195	1,855	1,441	806	1,030	719	579	415	291	346	336	14,439	12,873
2200	33	170	544	1,290	1,838	1,997	1,824	1,326	981	1,126	658	438	449	361	456	466	13,957	12,577
2300	26	230	917	1,881	2,305	2,527	2,059	1,643	937	1,038	555	438	350	287	654	312	16,159	14,931
2400	22	512	1,278	2,360	3,050	3,056	2,925	3,100	904	1,506	722	398	417	429	269	217	21,165	19,917
Total[a]	1,280	12,476	27,750	47,422	57,316	70,220	69,220	69,213	20,740	28,620	16,584	10,471	8,702	8,786	12,198	8,913	469,910	388,435
Adjusted[a]	1,101	9,713	22,628	40,215	49,690	55,859	56,479	53,608	17,621	24,777	14,155	8,792	7,594	7,709	10,689	7,807	388,435	

Appendix Table B.2. Left bank Anvik River adjusted sonar estimates by hour and sector, 2002.

Hour	Sector																	Total
Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total[a]	Adjusted[a]
100	0	23	54	156	334	618	895	1,062	1,469	2,030	855	600	417	299	241	232	9,285	9,338
200	35	34	97	217	378	624	964	1,152	1,553	1,912	773	427	288	157	186	102	8,899	8,853
300	1	23	99	305	478	679	1,011	1,155	1,456	1,974	749	442	266	167	157	41	9,003	8,975
400	8	24	90	205	323	454	706	900	1,293	1,642	626	340	207	107	116	56	7,097	7,091
500	0	16	52	113	181	325	600	775	1,091	1,471	637	391	216	120	83	64	6,135	6,133
600	0	15	28	63	159	345	596	779	1,163	1,685	768	422	213	92	76	58	6,462	6,422
700	7	32	45	59	108	289	459	565	1,034	1,532	558	297	195	98	140	91	5,509	5,138
800	4	12	24	33	98	236	547	783	1,041	1,506	574	273	134	65	86	82	5,498	5,147
900	1	4	16	37	107	266	521	665	1,093	1,319	592	344	187	73	94	71	5,390	5,041
1000	0	4	16	33	84	195	427	575	957	1,274	589	373	250	122	118	96	5,113	4,890
1100	1	17	18	31	84	200	380	534	885	1,426	680	434	272	156	221	123	5,462	5,105
1200	2	16	24	43	77	171	348	485	776	1,152	559	388	239	117	210	104	4,711	4,544
1300	4	15	19	37	75	163	307	444	623	853	518	377	197	159	180	131	4,102	4,113
1400	1	7	21	37	99	227	374	511	774	1,099	571	412	204	112	190	79	4,718	4,492
1500	3	22	63	95	150	236	489	597	841	1,089	544	407	231	160	232	90	5,249	5,051
1600	6	16	14	51	105	273	510	675	868	1,223	525	330	225	234	180	140	5,375	4,946
1700	5	17	28	46	119	324	618	699	870	1,154	607	507	310	205	205	145	5,859	5,410
1800	1	24	30	101	256	541	854	956	996	1,190	552	413	258	186	136	88	6,582	5,953
1900	9	39	53	91	235	604	1,021	1,150	1,138	1,545	669	901	256	350	304	248	8,613	8,521
2000	0	12	24	101	371	853	1,222	1,122	1,048	1,346	581	399	353	235	215	149	8,031	7,919
2100	2	7	29	100	347	778	1,315	1,236	1,216	1,579	598	427	340	145	209	183	8,511	8,121
2200	5	12	39	95	314	794	1,294	1,437	1,624	1,990	754	529	379	309	230	202	10,007	9,610
2300	0	9	26	116	274	678	1,375	1,508	1,731	2,150	827	529	290	180	237	119	10,049	9,232
2400	0	13	34	117	280	654	1,128	1,262	1,519	2,135	819	684	625	204	203	166	9,843	9,072
Total[a]	95	413	943	2,282	5,036	10,527	17,961	21,027	27,059	36,276	15,525	10,646	6,552	4,052	4,249	2,860	165,503	159,117
Adjusted[a]	93	396	913	2,235	4,924	10,297	17,465	20,379	25,733	34,541	14,725	10,015	6,413	3,956	4,200	2,832	159,117	

Appendix Table B.3. Right and left bank Anvik River adjusted sonar estimates by hour and sector, 2002.

Hour	Sector																	Total
Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total[a]	Adjusted[a]
100	40	534	1,473	2,505	3,061	4,038	4,528	5,002	2,473	3,482	1,845	1,166	804	671	683	548	32,853	28,391
200	111	917	2,551	2,932	3,184	5,022	5,718	5,872	2,913	3,719	1,635	911	702	707	1,017	524	38,435	29,530
300	134	1,399	2,605	3,506	3,856	5,051	6,199	6,159	2,457	3,204	1,611	918	697	722	1,045	602	40,165	30,183
400	105	1,615	2,737	3,210	3,429	4,872	5,480	6,857	2,054	2,791	1,304	734	599	561	1,259	816	38,423	27,522
500	70	792	1,784	3,328	3,597	5,208	6,198	6,445	2,133	2,804	1,479	920	659	684	1,114	587	37,802	27,580
600	124	919	1,715	3,418	4,051	5,952	5,130	7,395	2,352	3,334	1,727	981	627	523	642	498	39,388	30,320
700	38	884	1,450	2,339	2,844	5,788	4,364	5,673	2,187	3,132	1,445	850	578	468	557	365	32,962	25,862
800	41	574	1,264	1,863	2,521	3,230	3,606	3,584	2,027	2,956	1,504	785	566	476	648	401	26,046	24,469
900	60	525	1,197	2,030	2,536	3,397	3,499	3,504	1,978	2,628	1,274	784	490	417	542	476	25,337	23,820
1000	48	404	899	1,644	2,450	2,912	3,391	3,055	1,808	2,596	1,295	817	591	466	522	467	23,365	22,169
1100	20	293	768	1,396	2,148	2,688	3,229	3,181	1,747	2,684	1,331	856	622	539	826	535	22,863	21,550
1200	39	273	520	1,280	1,849	2,328	2,811	2,726	1,507	2,473	1,344	921	589	418	634	442	20,154	19,045
1300	35	240	566	1,306	1,941	2,250	2,636	2,693	1,528	1,958	1,152	769	570	494	558	494	19,190	18,402
1400	50	279	726	1,629	2,697	2,198	2,348	2,349	1,384	2,085	1,082	788	597	386	581	377	19,556	17,976
1500	45	364	1,004	1,713	1,948	1,937	2,229	2,025	1,468	1,995	1,090	747	420	382	495	335	18,197	16,781
1600	78	351	788	1,570	1,666	1,973	1,976	1,803	1,346	2,078	934	580	389	420	423	403	16,778	15,151
1700	105	416	922	1,374	1,618	1,754	2,068	1,768	1,288	1,833	1,114	809	568	462	484	474	17,057	15,087
1800	23	291	717	1,973	1,860	2,104	2,256	2,007	1,462	1,834	933	662	547	467	550	397	18,083	16,032
1900	21	349	836	1,725	2,184	2,308	2,633	2,621	2,108	2,438	1,181	1,260	599	725	664	542	22,194	20,512
2000	37	261	717	1,522	2,465	3,058	3,107	2,568	1,861	2,318	1,177	837	775	644	599	489	22,435	20,837
2100	65	263	616	1,582	2,386	2,973	3,170	2,677	2,022	2,609	1,317	1,006	755	436	555	519	22,950	20,993
2200	38	182	583	1,385	2,152	2,791	3,118	2,763	2,605	3,116	1,412	967	828	670	686	668	23,964	22,188
2300	26	239	943	1,997	2,579	3,205	3,434	3,151	2,668	3,188	1,382	967	640	467	891	431	26,208	24,163
2400	22	525	1,312	2,477	3,330	3,710	4,053	4,362	2,423	3,641	1,541	1,082	1,042	633	472	383	31,008	28,989
Total[a]	1,375	12,889	28,693	49,704	62,352	80,747	87,181	90,240	47,799	64,896	32,109	21,117	15,254	12,838	16,447	11,774	635,413	547,552
Adjusted[a]	1,194	10,108	23,541	42,451	54,614	66,155	73,944	73,987	43,354	59,318	28,880	18,806	14,007	11,665	14,888	10,639	547,552	

[a] Does not include periods with missing data.

Appendix Table B.4. Right bank Anvik River adjusted sonar estimated proportions by hour and sector, 2002.

Hour	Sector																	Total
Ending	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total[3]	Adjusted[4]
100	0.000	0.001	0.003	0.005	0.006	0.007	0.008	0.008	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.050	0.041
200	0.000	0.002	0.005	0.006	0.006	0.009	0.010	0.010	0.003	0.004	0.002	0.001	0.001	0.001	0.002	0.001	0.063	0.044
300	0.000	0.003	0.005	0.007	0.007	0.009	0.011	0.011	0.002	0.003	0.002	0.001	0.001	0.001	0.002	0.001	0.066	0.045
400	0.000	0.003	0.006	0.006	0.007	0.009	0.010	0.013	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.067	0.043
500	0.000	0.002	0.004	0.007	0.007	0.010	0.012	0.012	0.002	0.003	0.002	0.001	0.001	0.001	0.002	0.001	0.067	0.046
600	0.000	0.002	0.004	0.007	0.008	0.012	0.010	0.014	0.003	0.004	0.002	0.001	0.001	0.001	0.001	0.001	0.070	0.051
700	0.000	0.002	0.003	0.005	0.006	0.012	0.008	0.011	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.058	0.044
800	0.000	0.001	0.003	0.004	0.005	0.006	0.007	0.006	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.044	0.041
900	0.000	0.001	0.003	0.004	0.005	0.007	0.006	0.006	0.002	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.042	0.040
1000	0.000	0.001	0.002	0.003	0.005	0.006	0.006	0.005	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.039	0.037
1100	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.006	0.002	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.037	0.035
1200	0.000	0.001	0.001	0.003	0.004	0.005	0.005	0.005	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.033	0.031
1300	0.000	0.000	0.001	0.003	0.004	0.004	0.005	0.005	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.032	0.030
1400	0.000	0.001	0.002	0.003	0.006	0.004	0.004	0.004	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.032	0.029
1500	0.000	0.001	0.002	0.003	0.004	0.004	0.004	0.003	0.001	0.002	0.001	0.001	0.000	0.000	0.001	0.001	0.028	0.025
1600	0.000	0.001	0.002	0.003	0.003	0.004	0.003	0.002	0.001	0.002	0.001	0.001	0.000	0.000	0.001	0.001	0.024	0.022
1700	0.000	0.001	0.002	0.003	0.003	0.003	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.024	0.021
1800	0.000	0.001	0.001	0.004	0.003	0.003	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.024	0.021
1900	0.000	0.001	0.002	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.029	0.026
2000	0.000	0.001	0.001	0.003	0.004	0.005	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.031	0.027
2100	0.000	0.001	0.001	0.003	0.004	0.005	0.004	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.031	0.027
2200	0.000	0.000	0.001	0.003	0.004	0.004	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.030	0.027
2300	0.000	0.000	0.002	0.004	0.005	0.005	0.004	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.034	0.032
2400	0.000	0.001	0.003	0.005	0.006	0.007	0.006	0.007	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.000	0.045	0.042
Total[4]	0.003	0.027	0.059	0.101	0.122	0.149	0.147	0.147	0.044	0.061	0.035	0.022	0.019	0.019	0.026	0.019	1.000	0.827
Adjusted[5]	0.002	0.021	0.048	0.086	0.106	0.119	0.120	0.114	0.037	0.053	0.030	0.019	0.016	0.016	0.023	0.017	0.827	

Appendix Table C.1 Anvik River summer chum salmon escapement age and sex composition by stratum, and weighted season total, 2002.

		Brood Year and Age Group				
		1999	1998	1997	1996	
		0.2	0.3	0.4	0.5	Total
Stratum:	6/22-7/02		*Stratum 1*			
Sample Size:	137					
Female	No. in Escapement	0	38,979	18,296	1,591	58,866
	Percent of Sample	0.0	35.8	16.8	1.5	54.0
Male	No. in Escapement	0	31,024	18,296	795	50,115
	Percent of Sample	0.0	28.5	16.8	0.7	46.0
Total	No. in Escapement	0	70,002	36,592	2,386	108,981
	Percent of Sample	0.0	64.2	33.6	2.2	100.0
Stratum:	7/03-7/06		*Stratum 2*			
Sample Size:	90					
Female	No. in Escapement	1,897	48,380	5,692	0	55,969
	Percent of Sample	2.22	56.7	6.7	0.0	65.6
Male	No. in Escapement	0	21,819	7,589	0	29,408
	Percent of Sample	0.0	25.6	8.9	0.0	34.4
Total	No. in Escapement	1,897	70,199	13,281	0	85,377
	Percent of Sample	2.22	82.2	15.6	0.0	100.0
Stratum:	7/07-7/12		*Stratum 3*			
Sample Size:	93					
Female	No. in Escapement	3,376	77,651	18,569	1,688	101,285
	Percent of Sample	2.15	49.5	11.8	1.1	64.5
Male	No. in Escapement	0	47,266	8,440	0	55,706
	Percent of Sample	0.0	30.1	5.4	0.0	35.5
Total	No. in Escapement	3,376	124,918	27,009	1,688	156,991
	Percent of Sample	2.15	79.6	17.2	1.1	100.0
Stratum:	7/13-7/24		*Stratum 4*			
Sample Size:	150					
Female	No. in Escapement	3,614	53,493	5,783	723	63,613
	Percent of Sample	3.36	49.7	5.4	0.7	59.1
Male	No. in Escapement	0	33,975	7,229	2,892	44,096
	Percent of Sample	0.0	31.5	6.7	2.7	40.9
Total	No. in Escapement	3,614	87,468	13,012	3,614	107,709
	Percent of Sample	3.36	81.2	12.1	3.4	100.0
Stratum:	6/22-7/24		*Season Total*			
Sample Size:	470					
Female	No. in Escapement	8,888	218,503	48,340	4,002	279,733
	Percent of Sample	1.94	47.6	10.5	0.9	60.9
Male	No. in Escapement	0	134,084	41,554	3,687	179,325
	Percent of Sample	0.0	29.2	9.1	0.8	39.1
Total	No. in Escapement	8,888	352,587	89,894	7,689	459,058
	Percent of Sample	1.9	76.8	19.6	1.7	100.0